Nokia Customer Care

Service Manual

RM-249; RM-250 (Nokia 7500; Nokia 7500b)
Mobile Terminal
Part No: 9205338 (Issue 1)

COMPANY CONFIDENTIAL

NOKIA
Care

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
Original issue	06/2007	J Bryman	

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The availability of particular products may vary by region.

IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Nokia 7500; Nokia 7500b Service Manual Structure

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2 Service Devices and Service Concepts
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4 RF Troubleshooting and Manual Tuning Guide
5 System module
Glossary

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1 — General information

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Product selection

There are two variants of this phone:

RM-249/Nokia 7500 operates on bands GSM900/1800/1900.

RM-250/Nokia 7500b is the North America version, operating on bands GSM850/1800/1900.

Apart from RF, the two variants have the same hardware features.

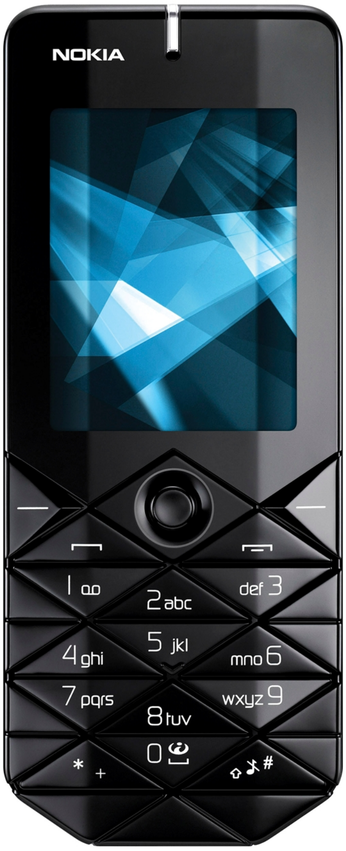

Figure 1 View of RM-249/250

Phone features

General features

- Demo mode (phone demo without SIM card)

Display and keypad features

- Main display: Active TFT QVGA display supporting up to 16,7 million colors (320 x 240 pixels, 2 inches active area)
- Power switch
- Side volume keys
- Camera capture key

Hardware characteristics

- Monoblock phone
- 2-Mpix camera with 8 x digital zoom
- µSD memory card slot (under the battery cover)

- Stereo FM radio and music player
- Integrated handsfree speaker
- Internal vibra
- Bluetooth
- 2.0 mm DC charger plug interface
- Mini-USB connector
- 2.5 mm Nokia AV connector

Software and User interface features

Software features

- ISA OS 8.0s Platform
- Nokia Series 40 User interface (UI): Java™ MIDP 2.0

UI features

Imaging	• 2.0-megapixel camera with 8x digital zoom (1600 x 1200 pixel resolution) • Full-screen viewfinder • PictBridge printing via USB cable
Multimedia	• MP3 player supporting formats including MP3, Midi, AAC, AAC+, enhanced AAC+, WMA • FM stereo radio, Visual Radio and music player • 3GPP video player/recorder • MP3 ringing tones, True tones and MIDI tones, with support of 64 polyphony
Memory functions	• Combo memory with 64 MB flash, about 40 MB user memory (for gallery and applications, contacts, notes, calendar entries)
Messaging	• Simplified messaging with recently used contacts log and groups • Email: Access your work and private email accounts; supports SMTP, POP3, and IMAP4 protocols. Support for attachments (Java version) • Audio messaging service (AMS): Record your own voice message and send to compatible devices • MMS OMA 1.2: Combine image, video, text, and voice clips and send as an MMS to a compatible phone or PC; use MMS to tell your story with a multi-slide presentation. The MMS OMA 1.2 specification allows you to send/receive messages up to 300 kB in size. • Text messaging: Supports concatenated SMS, picture messaging, SMS distribution list • Predictive text input: Support for all major languages in Europe and Asia-Pacific • Instant Messaging (IM)

Applications	• Java™ MIDP 2.0 with over-the-air download • Pre-installed Java™-based applications and games • SIM Application Toolkit
Connectivity	• Nokia PC Suite with USB and Bluetooth connectivity • Bluetooth wireless connectivity (SIM access, headset, and handsfree profiles) incl. stereo support for headsets • Nokia AV connector interface with USB • FOTA (Flashing over-the-air) • Local/remote SyncML data synchronization
Browsing	• Integrated XHTML browser • Smart content download - OMA DRM 2.0
Data transfer	• EDGE (EGPRS): Class 10, download up to 236.8 kbps • GPRS: Class 10, download up to 53.6 kbps **Note:** Actual achieved speeds may vary depending on network support • GPRS/EDGE/HSCSD/CSD for browsing and as data modem • Downlink Advanced Receiver Performance (DARP)
Voice features	• Push To Talk: Select the person or group you want to talk to and press the Push To Talk key to communicate • Enhanced voice dialling with SIND: Speaker-independent name dialling for easy call handling • Integrated handsfree speaker with a new high quality speaker for better audio experience (stereo widening effects when attaching the headset) • Voice commands • Voice recorder
Digital services	• User Interface (UI) themes including e.g. animated wallpapers, screensavers, color schemes, ringing tones • Ringing tones: Video, MP3 ringing tones, True Tones and MIDI ringing, alert, and gaming tones with support of 64 polyphony • OTA download possibility for: Themes, True Tones, MP3 ringing tones, MIDI ringing tones, screensavers, wallpapers, 3GPP streaming, images and videos, Series 40 Java games and applications
Personal information management (PIM)	• Organizer with alarm clock, calendar, to-do list, notes, calculator, countdown timer, and stopwatch • Manage your time and information with the enhanced calendar that can be synchronized, for example, with Microsoft and Lotus PIM application calendars by using the Nokia PC Suite
Call management	• Speed dialling • Logs: Keeps lists of your dialled, received, and missed calls • Automatic answer (works with headset or car kit only) • Call waiting, call hold, call divert, call timer

Accessories

Type designator	Marketing name
Audio	
AD-50	Universal Headset Adapter
HS-40	Wired Headset
HS-47	Wired stereo Headset
HS-60	Wired Fashion stereo Headset
HS-81	Wired Headset
HS-24W	Nokia Bluetooth Headset BH-800
HS-25W	Nokia Bluetooth Headset BH-900
HS-38W	Nokia Bluetooth Headset BH-202
HS-39W	Nokia Bluetooth Headset BH-500
HS-50W	Nokia Bluetooth Headset BH-300
HS-51W	Nokia Bluetooth Headset BH-301
HS-57W	Nokia Bluetooth Headset BH-700
HS-58W	Nokia Bluetooth Headset BH-200
HS-59W	Nokia Bluetooth Headset BH-600
HS-64W	Nokia Bluetooth Headset BH-801
HS-68W	Nokia Bluetooth Headset BH-203
HS-71W	Nokia Bluetooth Headset BH-501
HS-73W	Nokia Bluetooth Headset BH-302
HS-78W	Nokia Bluetooth Headset BH-100
HS-84W	Nokia Bluetooth Headset BH-204
HS-85W	Nokia Bluetooth Headset BH-206
HS-86W	Nokia Bluetooth Headset BH-207
HS-88W	Nokia Bluetooth Headset BH-205
Charger	
AC-3	Charger
AC-4	Travel Charger
AC-5	Travel Charger
CA-44	Charger Adapter
Car	
CK-20W	Multimedia Car Kit
CR-39	Universal holder
DC-4	Mobile Charger

Type designator	Marketing name
HF-33W	Wireless Plug-in Car Handsfree
HF-35W	Wireless Plug-in Car Handsfree
HF-6W	Wireless Plug-in Car Handsfree
HH-12	Holder Easy Mount
HSU-4	Privacy Handset
N616	Car Kit
N810	Car Phone
Music	
AD-42W	Audio Gateway
MD-3	Music Speakers
MD-4	Music Speakers
Messaging	
SU-27W	Digital Pen
Power	
BL-4B	Battery, 700 mAh, Li-ion
Positioning	
LD-3W	Wireless GPS Module
Memory cards	
MU-22	Memory unit 1GB
MU-25	Memory unit 64MB
MU-26	Memory unit 128MB
MU-27	Memory unit 256MB
MU-28	Memory unit 512MB
MU-37	Memory unit 2GB

Specifications

General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
Transceiver with BL-4B 700 mAh Li-Ion battery pack	106,8 x 43,8 x 13,1	100	55,6

Battery endurance

Battery	Talk time	Standby time
BL-4B 700 mAh Li-ion	Up to 2.8 hours	Up to 250 hours

Note: Variation in operation times will occur depending on SIM card, network settings and usage. Talk time is increased by up to 30% if half rate is active, and reduced by 5% if enhanced full rate is active.

2 — Service Devices and Service Concepts

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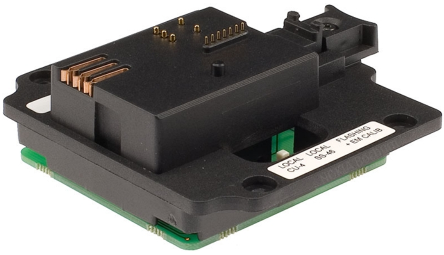
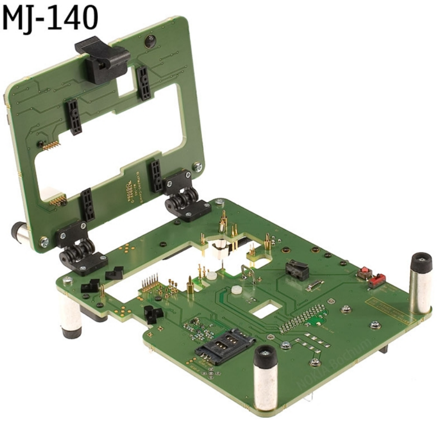
Service devices

Product specific devices

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-249; RM-250, refer to various concepts.

<table>
<tr><td rowspan="2"></td><td>FS-55</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">For flashing (also dead phones) with SS-64. RF testing and tuning, and EM calibration on ATO level with SS-62 (mechanical locking concept), CU-4 supported.</td></tr>
<tr><td rowspan="2">MJ-140
</td><td>MJ-140</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-140 is meant for troubleshooting, testing, tuning and flashing on the engine level (CU-4 supported).
The jig includes an RF interface for GSM and Bluetooth.
The following table shows the attenuation values for galvanic RF connetion:
•
<table>
<tr><th>Band</th><th>Tuning channel</th><th>Attenuation RX</th><th>Attenuation TX</th></tr>
<tr><td>GSM850</td><td>190</td><td>0,1</td><td>0,1</td></tr>
<tr><td>GSM900</td><td>37</td><td>0,1</td><td>0,1</td></tr>
<tr><td>GSM1800</td><td>700</td><td>0,15</td><td>0,15</td></tr>
<tr><td>GSM1900</td><td>661</td><td>0,15</td><td>0,15</td></tr>
</table></td></tr>
<tr><td rowspan="2"> </td><td>RJ-172</td><td>Soldering jig</td><td></td></tr>
<tr><td colspan="3">RJ-172 is a soldering jig used for soldering and as a rework jig for the engine module.</td></tr>
</table>

SA-123	RF coupler	

SA-123 is an RF coupler for GSM RF testing. It is used together with the product-specific flash adapter.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-123:

- **RM-249**

Band	Channel	Tx-att. (dB)	Rx-att. (dB)
GSM 900	Low	5.3	3
	Mid	4.5	5
	High	4.8	5
GSM 1800	Low	9.2	7
	Mid	8.5	8
	High	7.5	8
GSM 1900	Low	6.5	8
	Mid	6.6	9
	High	7.0	8

Tx-attenuation tolerance is +/-0.5 dB

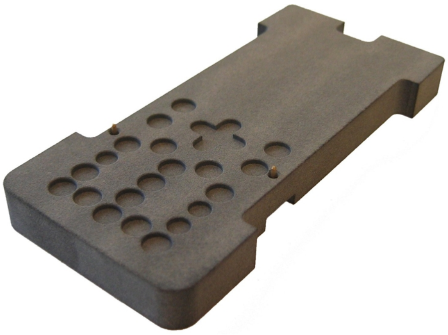
Rx-attenuation tolerance is +/-1.0dB

- **RM-250**

Band	Channel	Tx-att. (dB)	Rx-att. (dB)
GSM 850	Low	7.5	6
	Mid	7.0	5
	High	6.6	5
GSM 1800	Low	8.5	7
	Mid	8.0	7
	High	6.6	6
GSM 1900	Low	5.8	7
	Mid	5.8	8
	High	6.1	8

Tx-attenuation tolerance is +/-0.5 dB

Rx-attenuation tolerance is +/-1.0dB

<table>
<tr><td rowspan="2"></td><td>SS-101</td><td>Domesheet
alignment jig</td><td></td></tr>
<tr><td colspan="3">The purpose of this tool is to support the placement of a domesheet to the PWB.</td></tr>
</table>

General devices

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-249; RM-250, refer to various concepts.

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

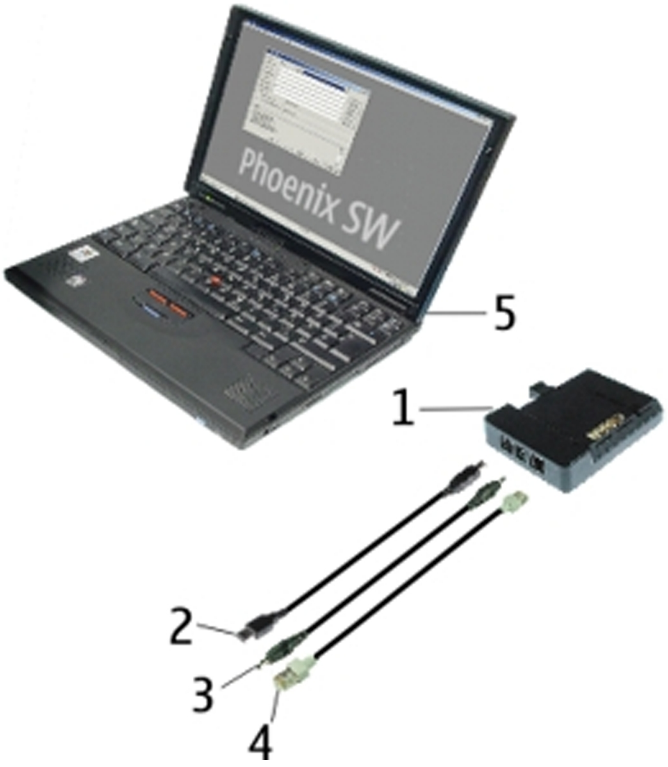
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1 Connect a service tool (jig, flash adapter) to CU-4.
2 Connect CU-4 to your PC with a USB cable.
3 Connect supply voltage (12 V)
4 Connect an FBUS cable (if necessary).
5 Start Phoenix service software.

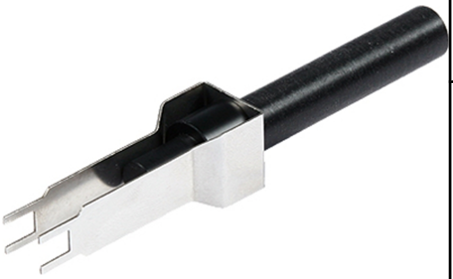
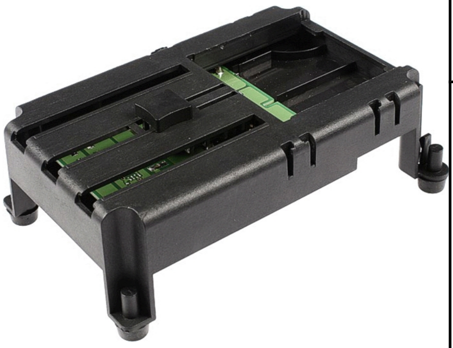
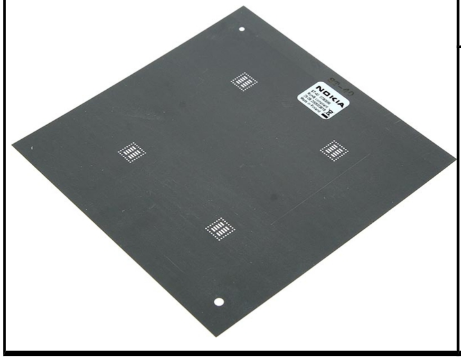


Note: Phoenix enables CU-4 regulators via USB when it is started.

Reconnecting the power supply requires a Phoenix restart.

<table>
<tr><td rowspan="2"> </td><td>FLS-4S</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.</td></tr>
<tr><td rowspan="2"> </td><td>FLS-5</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.</td></tr>
<tr><td rowspan="2"> </td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:
• PC
• Control unit
• Flash adapter
• Smart card
FPS-10 flash prommer features:
• Flash functionality for BB5 and DCT-4 terminals
• Smart Card reader for SX-2 or SX-4
• USB traffic forwarding
• USB to FBUS/Flashbus conversion
• LAN to FBUS/Flashbus and USB conversion
• Vusb output switchable by PC command
FPS-10 sales package includes:
• FPS-10 prommer
• Power Supply with 5 country specific cords
• USB cable</td></tr>
</table>

	JBT-9	Bluetooth test and interface box (sales package)	
	The JBT-9 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing . Sales package includes: • JBT-9 test box • Installation and warranty information		
DESkey www.des.co.uk	PK-1	Software protection key	
	PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle. PK-1 is meant for use with a PC that does not have a series interface. To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.		
	PKD-1	SW security device	
	SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Without the device, it is not possible to use the service software. Printer or any such device can be connected to the PC through the device if needed.		
	RJ-93	Rework jig	
	RJ-93 is used as a rework jig for the engine module. This stencil takes the front end module (FEM) or power amplifier (PA) module for spreading the soldering paste to the component. Must be used together with the ST-40 stencil.		
	SPS-1	Soldering Paste Spreader	
	The SPS-1 allows spreading of solder to the LGA components pads over the rework stencils.		

<table>
<tr><td rowspan="2"> </td><td>SRT-6</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SRT-6 is used to open phone covers.</td></tr>
<tr><td rowspan="2"></td><td>SS-45</td><td>Front camera removal tool</td><td></td></tr>
<tr><td colspan="3">The front camera removal tool SS-45 is used to remove/attach the front camera module from/to the socket.</td></tr>
<tr><td rowspan="2"> </td><td>SS-46</td><td>Interface adapter</td><td></td></tr>
<tr><td colspan="3">SS-46 acts as an interface adapter between the flash adapter and FPS-10.</td></tr>
<tr><td rowspan="2"></td><td>SS-62</td><td>Generic flash adapter base for BB5</td><td></td></tr>
<tr><td colspan="3">• generic base for flash adapters and couplers
• SS-62 equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using galvanic connector or coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"></td><td>ST-40</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-40 is a rework stencil and used with RJ-93.</td></tr>
</table>

	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.		

Cables

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-249; RM-250, refer to various concepts.

	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		
	CA-35S	Power cable	
	CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		

<table>
<tr><td rowspan="2"> </td><td>DAU-9S</td><td>MBUS cable</td><td></td></tr>
<tr><td colspan="3">The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.
Note: Docking station adapters valid for DCT4 products.</td></tr>
<tr><td rowspan="2"> </td><td>DKE-2</td><td>Mini-USB cable</td><td></td></tr>
<tr><td colspan="3">USB to mini-USB connector cable.</td></tr>
<tr><td rowspan="2"> </td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.</td></tr>
<tr><td rowspan="2"> </td><td>XCS-4</td><td>Modular cable</td><td></td></tr>
<tr><td colspan="3">XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.</td></tr>
</table>

	XRE-2	Bluetooth cable	The bluetooth cable connects the bluetooth connector of the module jig to the bluetooth test box JBT-9.
	XRS-6	RF cable	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector approximately 610 mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WLAN: 0.6+-0.1dB

Service concepts

POS (Point of Sale) flash concept

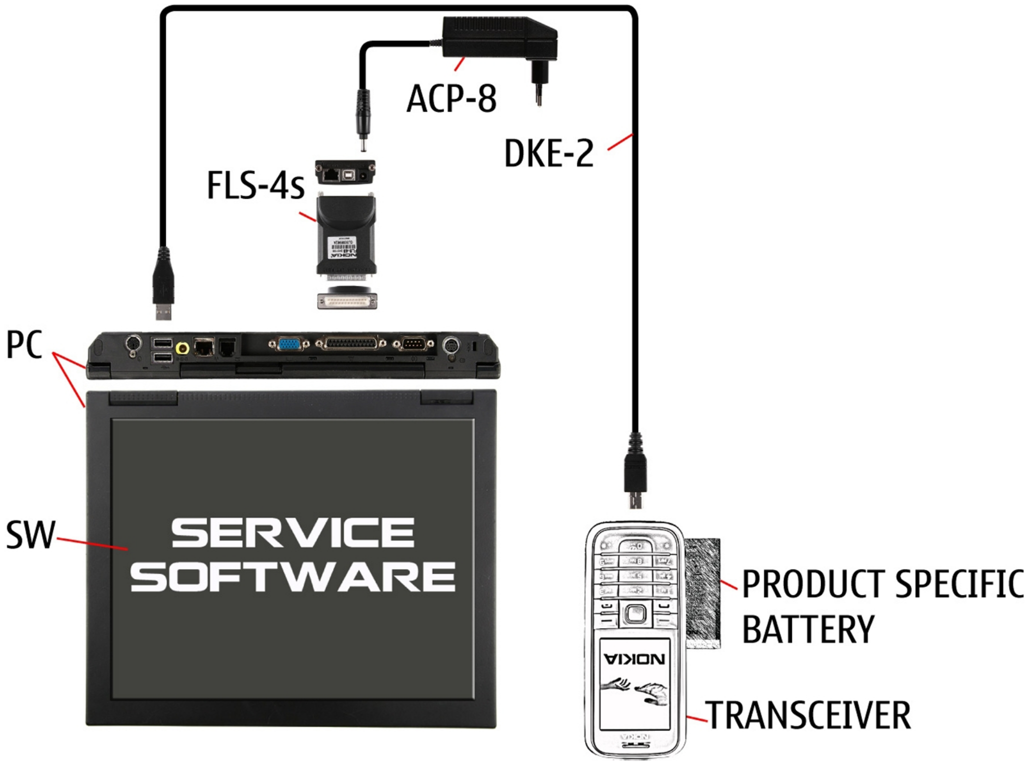

ACP-8
DKE-2
FLS-4s
PC
SW
SERVICE SOFTWARE
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Figure 2 POS flash concept

Type	Description
Product specific devices	
BL-4B	Battery
Other devices	
ACP-8	Power adapter
FLS-4S or FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
DKE-2	USB connectivity cable

Flash concept with FPS-10

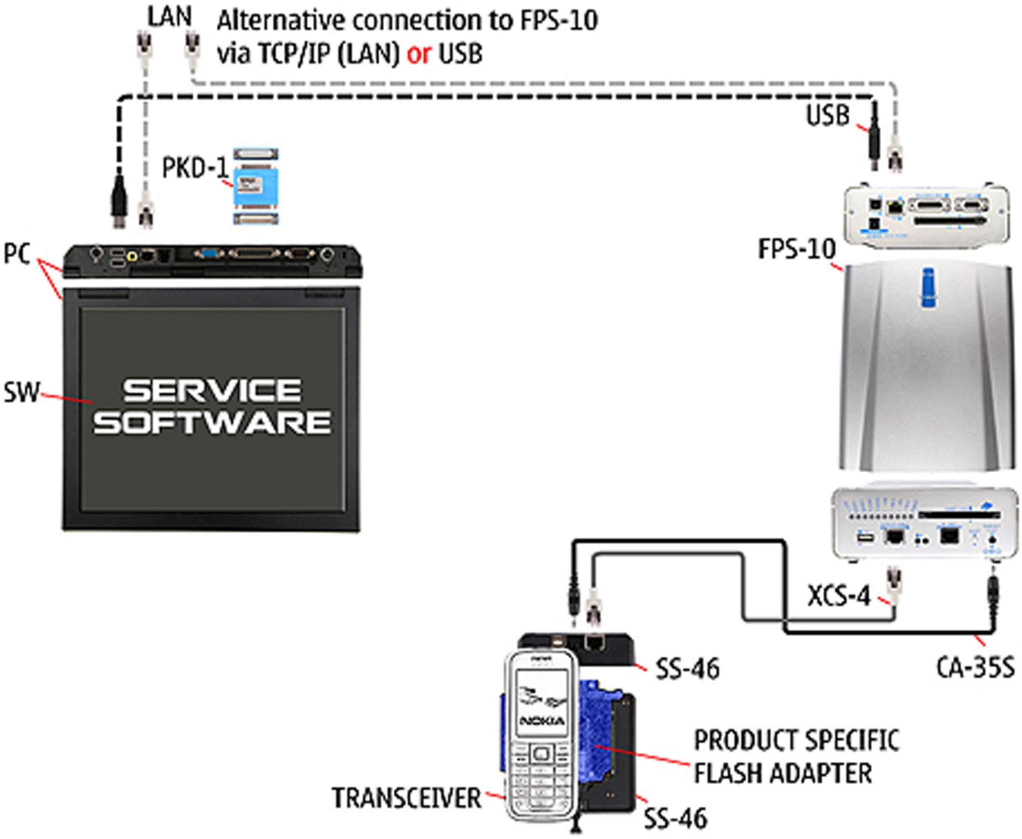

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
FPS-10
SW
SERVICE
SOFTWARE
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-55	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10

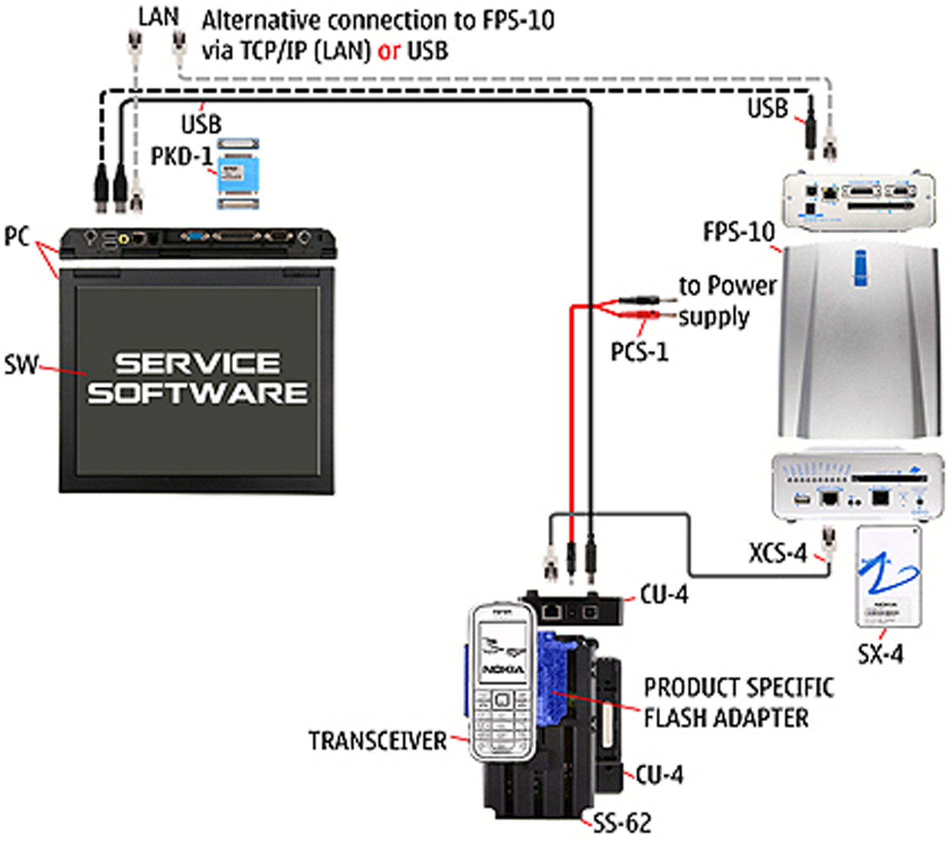

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
USB
PKD-1
PC
SW
SERVICE
SOFTWARE
FPS-10
to Power
supply
PCS-1
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-55	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

Module jig service concept

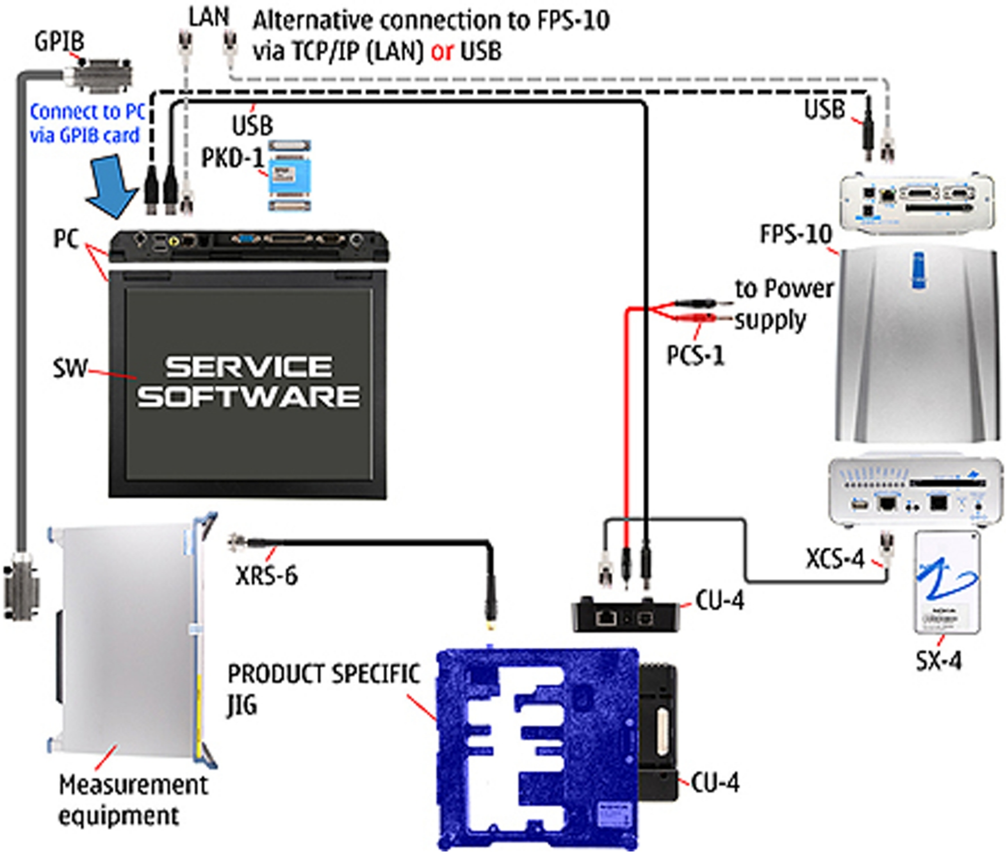

GPIB
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
Connect to PC
via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XRS-6
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC
JIG
CU-4
Measurement
equipment

Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-140	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
	USB cable

Type	Description
	GPIB control cable

RF testing concept with RF coupler

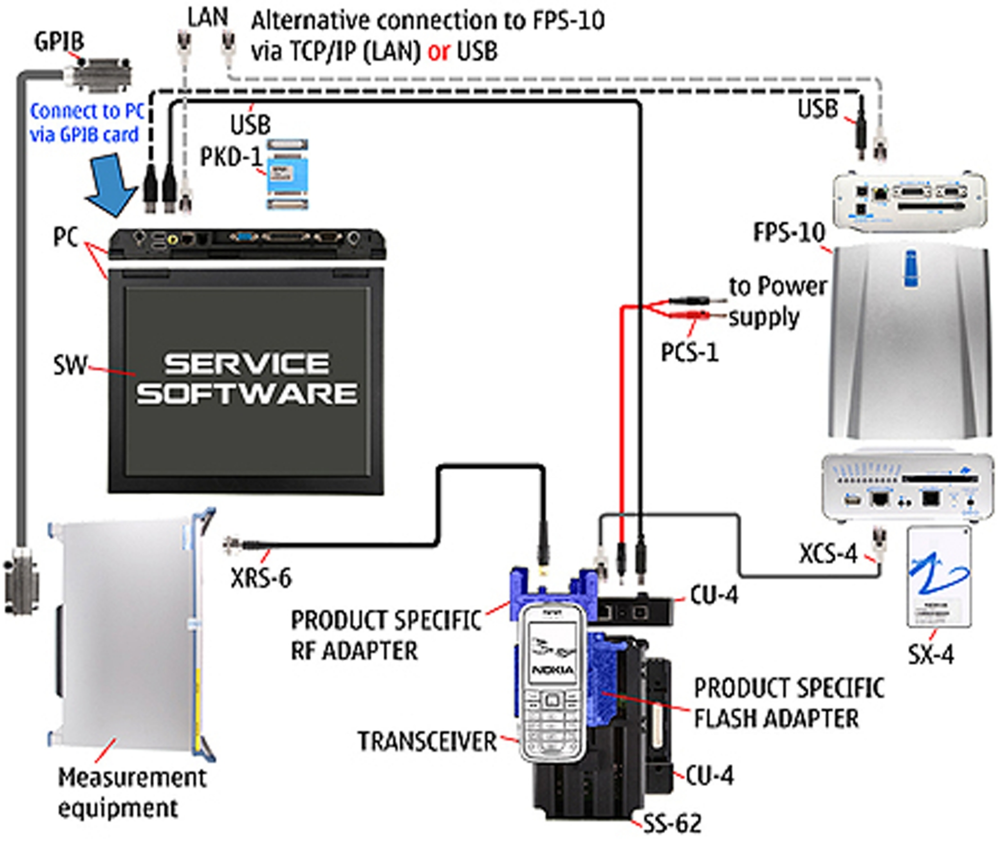

GPIB
LAN
Alternative connection to FPS-10 via TCP/IP (LAN) or USB
Connect to PC via GPIB card
USB
PKD-1
USB
FPS-10
PC
to Power supply
PCS-1
SW
SERVICE SOFTWARE
XRS-6
XCS-4
CU-4
PRODUCT SPECIFIC RF ADAPTER
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
Measurement equipment
SS-62

Figure 6 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-55	Flash adapter
SA-123	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable

Type	Description
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

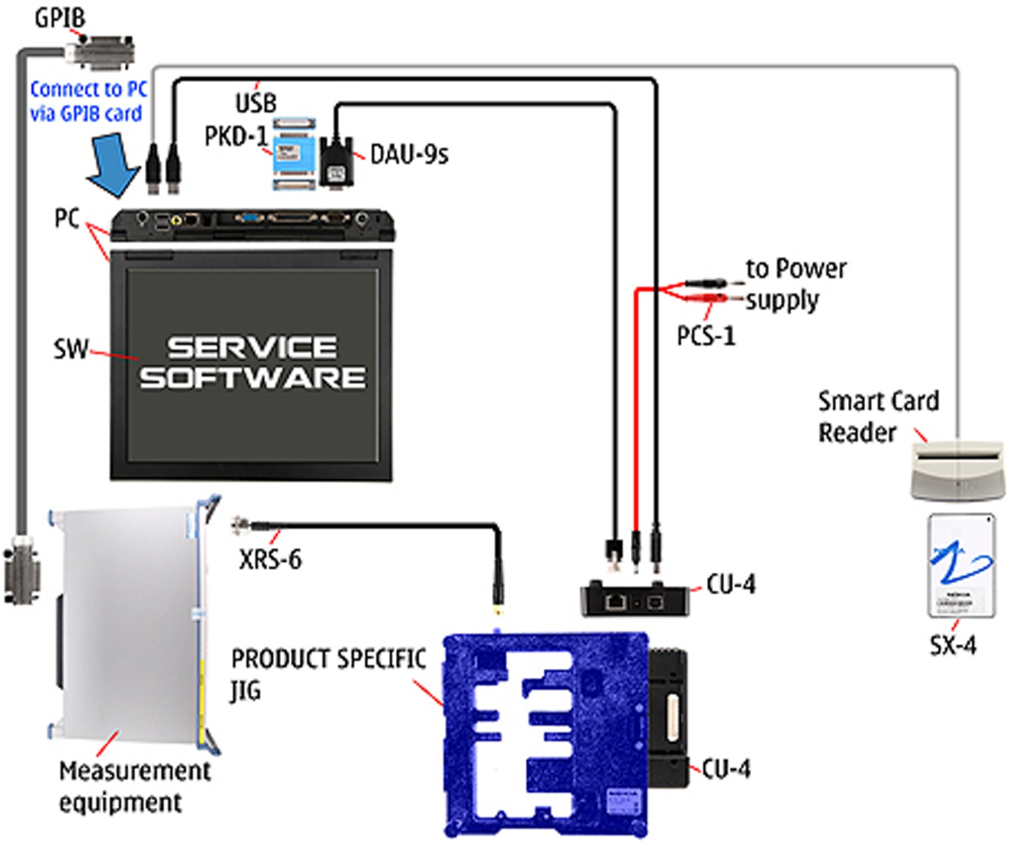

GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
SW
SERVICE SOFTWARE
to Power supply
PCS-1
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
CU-4
Measurement equipment

Figure 7 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-140	Module jig
Other devices	
CU-4	Control unit
PKD-1/PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software

Type	Description
Cables	
DAU-9s	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

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3 — BB Troubleshooting and Manual Tuning Guide

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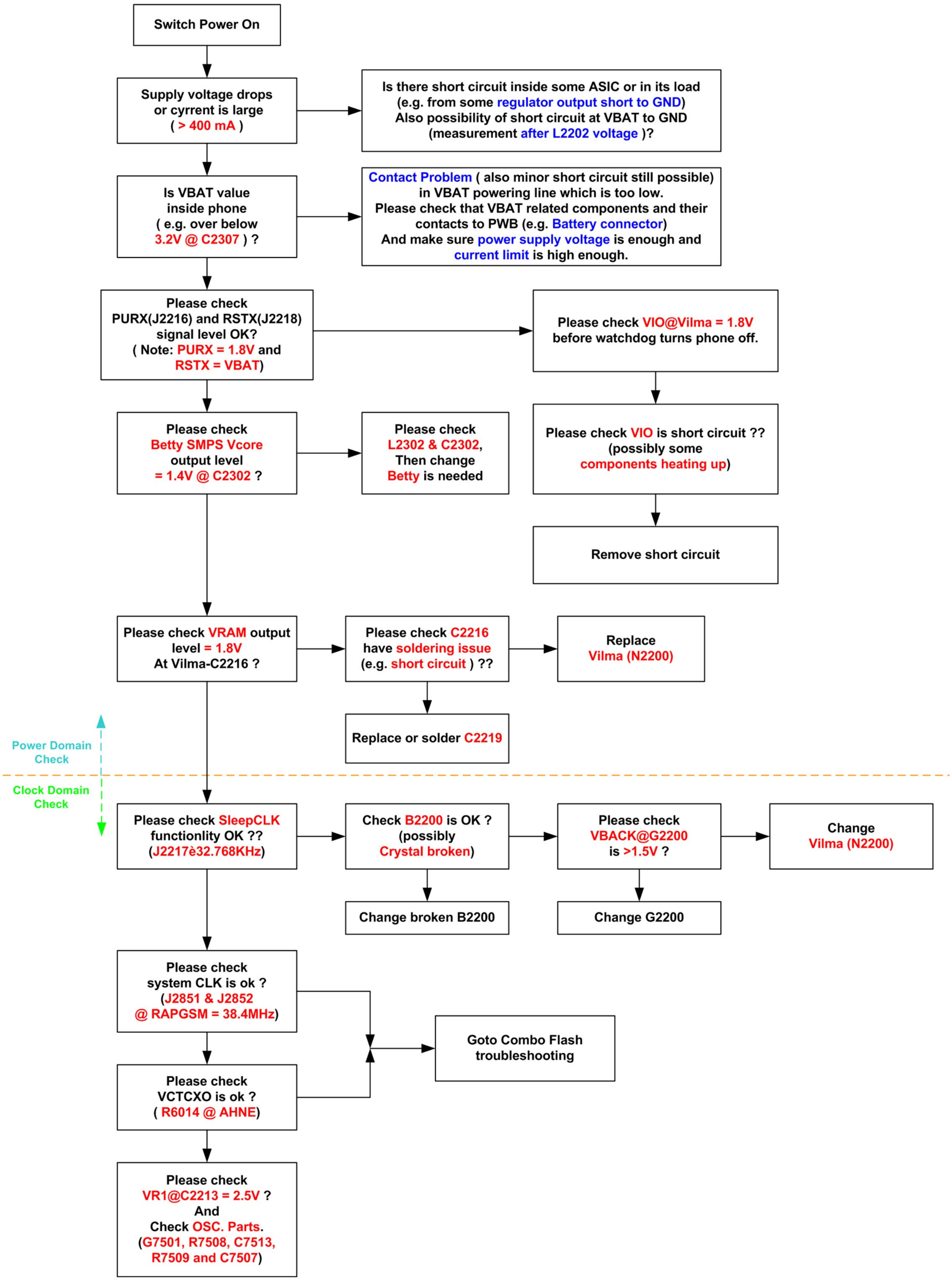
Figure 13 Internal audio signal flow 3–30

Power and charging troubleshooting

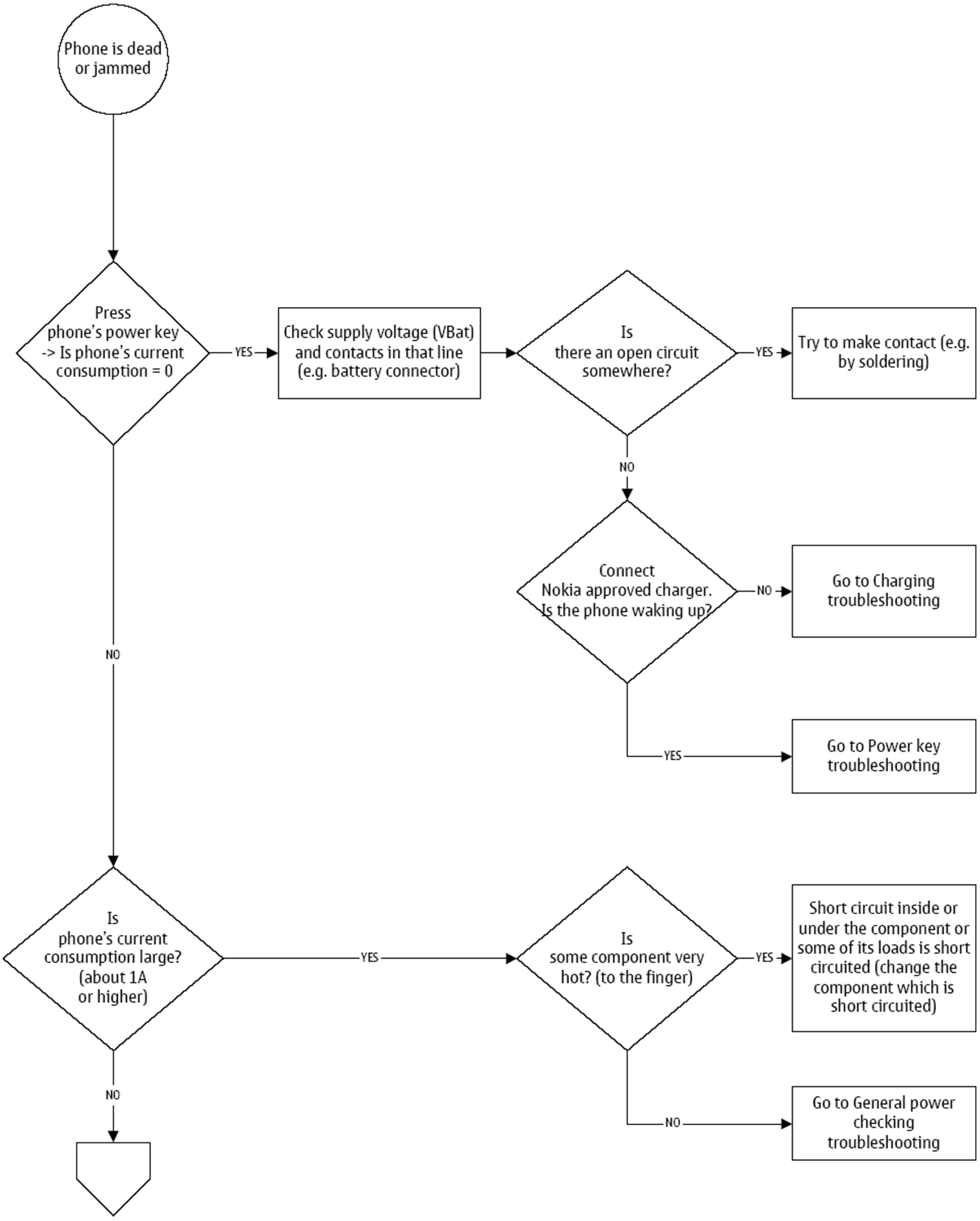
Cannot power on

Troubleshooting flow

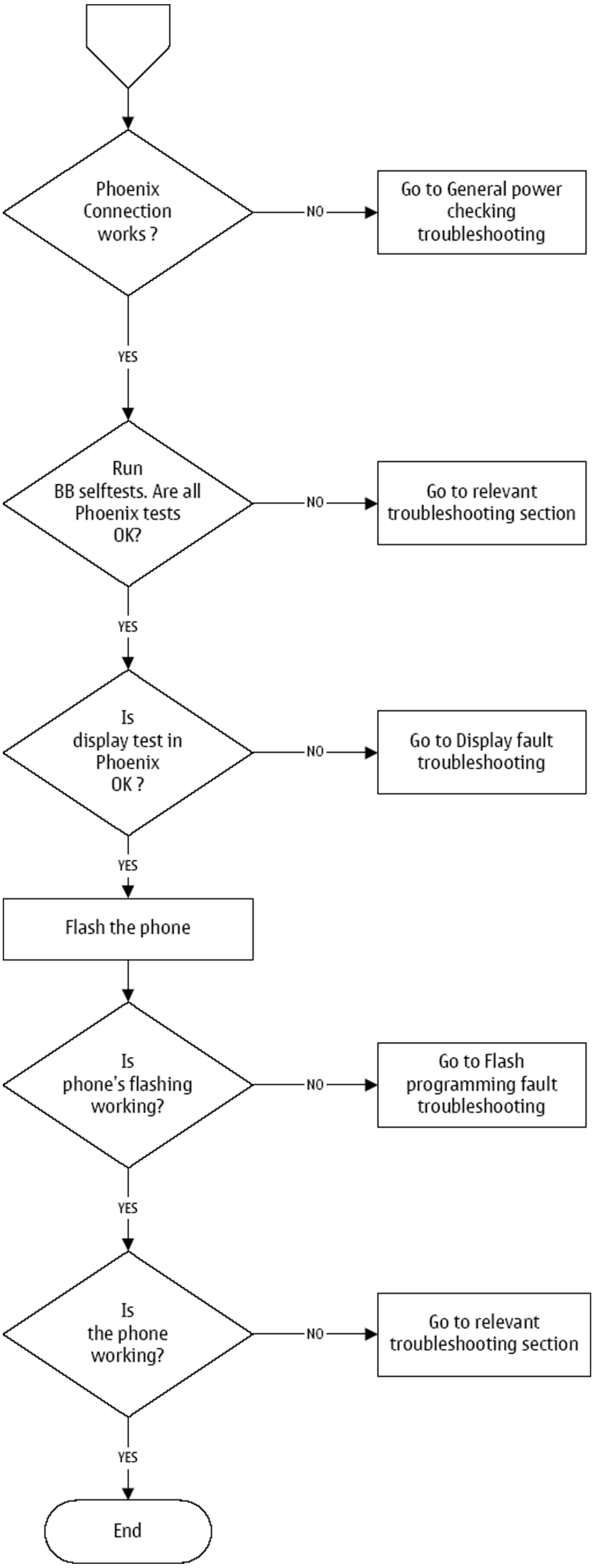

Switch Power On
Supply voltage drops or cyrrent is large (> 400 mA)
Is there short circuit inside some ASIC or in its load (e.g. from some regulator output short to GND) Also possibility of short circuit at VBAT to GND (measurement after L2202 voltage)?
Is VBAT value inside phone (e.g. over below 3.2V @ C2307) ?
Contact Problem (also minor short circuit still possible) in VBAT powering line which is too low. Please check that VBAT related components and their contacts to PWB (e.g. Battery connector) And make sure power supply voltage is enough and current limit is high enough.
Please check PURX(J2216) and RSTX(J2218) signal level OK? (Note: PURX = 1.8V and RSTX = VBAT)
Please check VIO@Vilma = 1.8V before watchdog turns phone off.
Please check VIO is short circuit ?? (possibly some components heating up)
Remove short circuit
Please check Betty SMPS Vcore output level = 1.4V @ C2302 ?
Please check L2302 & C2302, Then change Betty is needed
Please check VRAM output level = 1.8V At Vilma-C2216 ?
Please check C2216 have soldering issue (e.g. short circuit) ??
Replace Vilma (N2200)
Replace or solder C2219
Power Domain Check
Clock Domain Check
Please check SleepCLK functionlity OK ?? (J2217è32.768KHz)
Check B2200 is OK ? (possibly Crystal broken)
Please check VBACK@G2200 is >1.5V ?
Change Vilma (N2200)
Change broken B2200
Change G2200
Please check system CLK is ok ? (J2851 & J2852 @ RAPGSM = 38.4MHz)
Goto Combo Flash troubleshooting
Please check VCTCXO is ok ? (R6014 @ AHNE)
Please check VR1@C2213 = 2.5V ? And Check OSC. Parts. (G7501, R7508, C7513, R7509 and C7507)

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check supply voltage (VBat) and contacts in that line (e.g. battery connector)
Is there an open circuit somewhere?
YES
Try to make contact (e.g. by soldering)
NO
Connect Nokia approved charger. Is the phone waking up?
NO
Go to Charging troubleshooting
YES
Go to Power key troubleshooting
NO
Is phone's current consumption large? (about 1A or higher)
YES
Is some component very hot? (to the finger)
YES
Short circuit inside or under the component or some of its loads is short circuited (change the component which is short circuited)
NO
Go to General power checking troubleshooting
NO

Troubleshooting flow


Phoenix Connection works ?
NO
Go to General power checking troubleshooting
YES
Run BB selftests. Are all Phoenix tests OK?
NO
Go to relevant troubleshooting section
YES
Is display test in Phoenix OK ?
NO
Go to Display fault troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to Flash programming fault troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
End

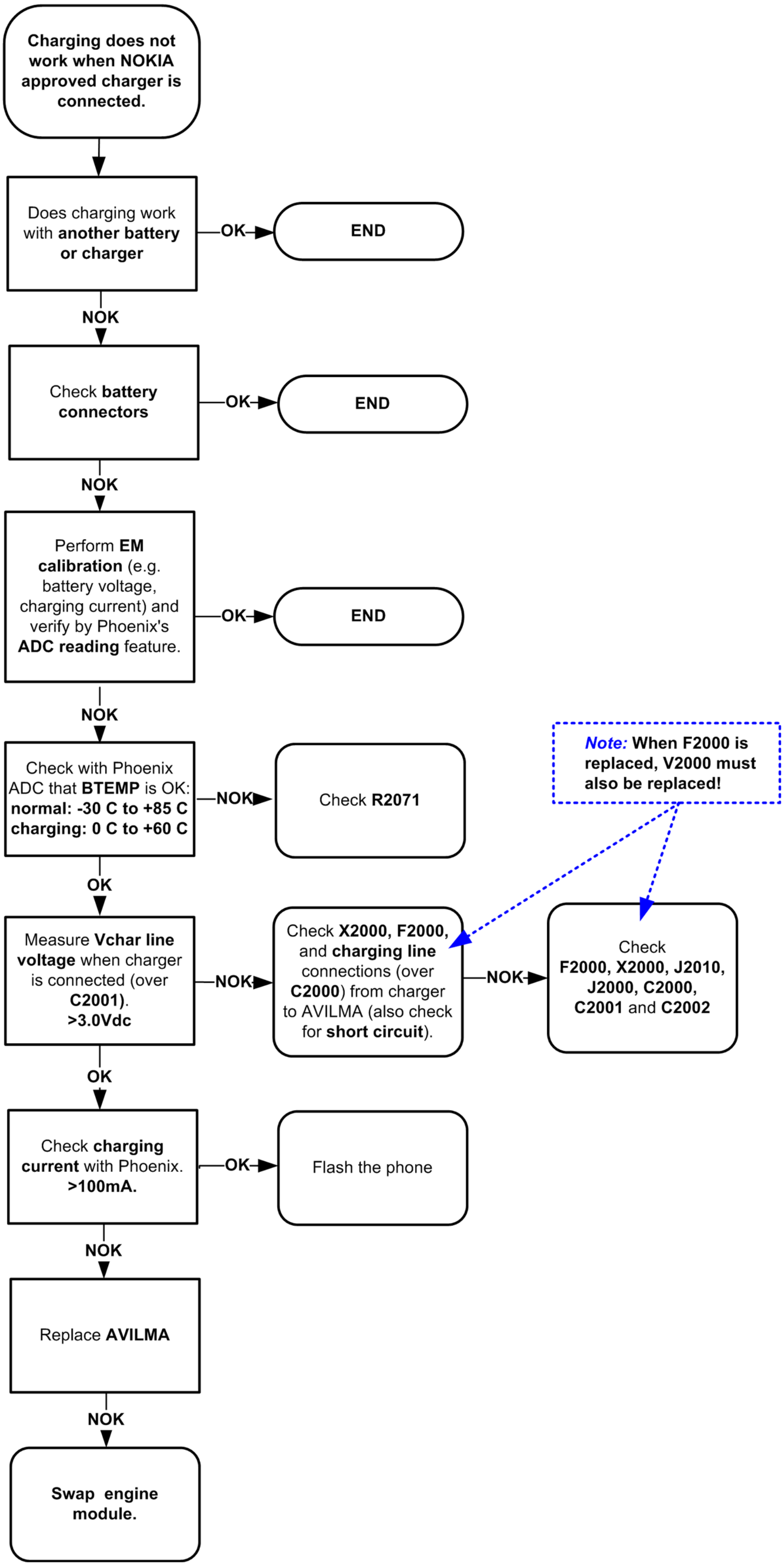
General power checking

Check the following voltages:

Signal Rename	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	AVILMA	ON	ON	1.82	Memory, I/Os, Display	
VBACK	AVILMA	ON	ON	2.5	Back-up battery	
VSIM1	AVILMA	ON	ON	1.8/3.0	SIM card	
VSIM2	AVILMA	OFF	OFF	1.8/3.0	Keyboard backlight	
VDRAM	AVILMA	ON	ON	1.82	SDRAM	
VAUX	AVILMA	OFF	OFF	2.5		
VANA	AVILMA	ON	ON	2.5	Audio, some pull-ups	
VR1	AVILMA	OFF	ON	2.5	Crystal oscillators	
VRFC	AVILMA	OFF	ON	1.8	RAP converters	
VRCP1	AVILMA			4.75	To RF parts	RF active
VREF	AVILMA	ON	ON	1.35	RF reference	
VCORE	BETTY	ON	ON	1.05 1.25 1.35 1.40	RAP digital	
VOUT	BETTY	OFF	OFF	2.5		Accessory connected
VCAM_2V8	LP3987ITLX-2.85/N1060	OFF	OFF	2.850	Camera	Disabled in sleep
VCAM_1V8	LM3671TLX-1.82/N1080	OFF	OFF	1.800	Camera	Disabled in sleep
VCAM_1V5	TPS62311YZDR/N1050	OFF	OFF	1.570	Camera	Disabled in sleep
2V8_FM_LCD	LP3985ITLX-2.85/N6050	ON	ON	2.850	LCD, Hall sensor	Only turned off in "Power off" mode
VSD	LP3928TLX-1828/N3200	OFF	OFF	2.850	MCC card	Disabled in sleep
LCD_LED_OUT	4w_LED_DRIVER	OFF	OFF	14.5	LCD Backlight	Disabled in sleep

Charging troubleshooting

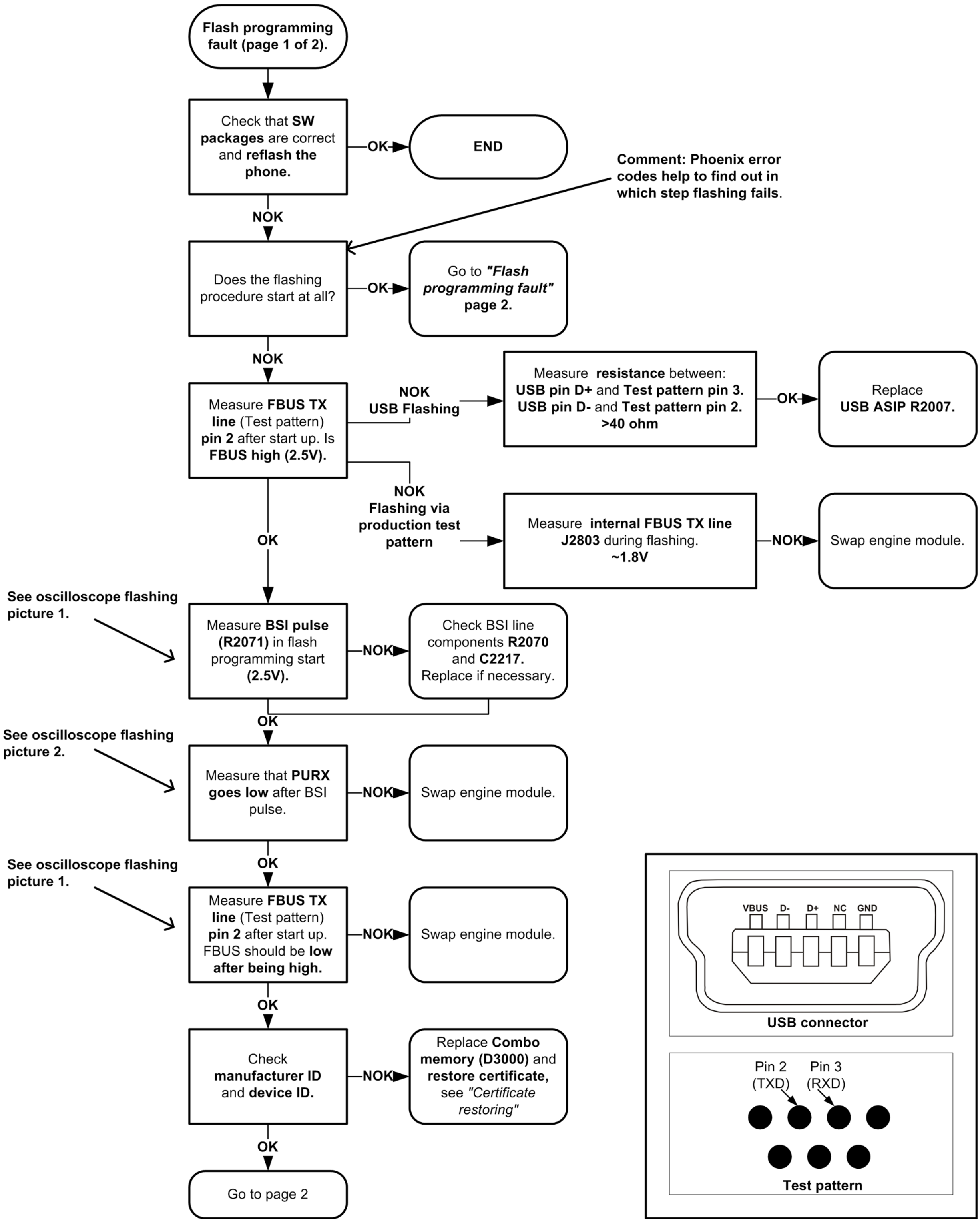
Troubleshooting flow


Charging does not work when NOKIA approved charger is connected.
Does charging work with **another battery or charger**
OK
END
NOK
Check **battery connectors**
OK
END
NOK
Perform **EM calibration** (e.g. battery voltage, charging current) and verify by Phoenix's **ADC reading** feature.
OK
END
NOK
Check with Phoenix ADC that **BTEMP** is OK: **normal: -30 C to +85 C charging: 0 C to +60 C**
NOK
Check **R2071**
Note: When F2000 is replaced, V2000 must also be replaced!
OK
Measure **Vchar line voltage** when charger is connected (over **C2001**). **>3.0Vdc**
NOK
Check **X2000, F2000,** and **charging line** connections (over **C2000**) from charger to AVILMA (also check for **short circuit**).
NOK
Check **F2000, X2000, J2010, J2000, C2000, C2001** and **C2002**
OK
Check **charging current** with Phoenix. **>100mA.**
OK
Flash the phone
NOK
Replace **AVILMA**
NOK
Swap engine module.

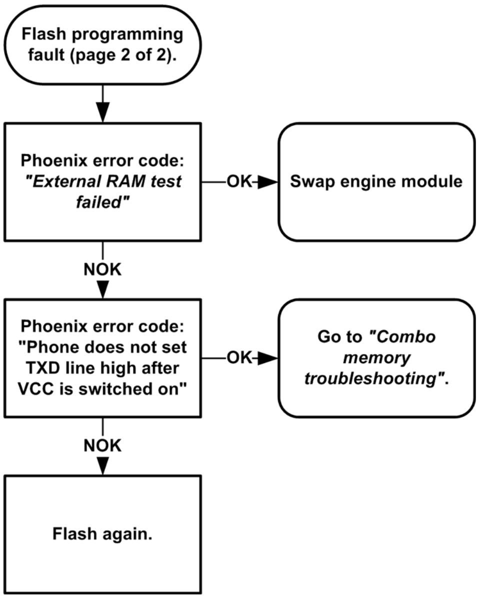
Interface troubleshooting

Flash programming fault troubleshooting

Part 1


Flash programming fault (page 1 of 2).
Check that SW packages are correct and reflash the phone.
OK
END
Comment: Phoenix error codes help to find out in which step flashing fails.
NOK
Does the flashing procedure start at all?
OK
Go to "Flash programming fault" page 2.
NOK
Measure FBUS TX line (Test pattern) pin 2 after start up. Is FBUS high (2.5V).
NOK
USB Flashing
Measure resistance between: USB pin D+ and Test pattern pin 3. USB pin D- and Test pattern pin 2. >40 ohm
OK
Replace USB ASIP R2007.
NOK
Flashing via production test pattern
Measure internal FBUS TX line J2803 during flashing. ~1.8V
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure BSI pulse (R2071) in flash programming start (2.5V).
NOK
Check BSI line components R2070 and C2217. Replace if necessary.
OK
See oscilloscope flashing picture 2.
Measure that PURX goes low after BSI pulse.
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure FBUS TX line (Test pattern) pin 2 after start up. FBUS should be low after being high.
NOK
Swap engine module.
OK
Check manufacturer ID and device ID.
NOK
Replace Combo memory (D3000) and restore certificate, see "Certificate restoring"
OK
Go to page 2
VBUS
D-
D+
NC
GND
USB connector
Pin 2 (TXD)
Pin 3 (RXD)
Test pattern

Part 2


Flash programming fault (page 2 of 2).
Phoenix error code: *"External RAM test failed"*
OK
Swap engine module
NOK
Phoenix error code: "Phone does not set TXD line high after VCC is switched on"
OK
Go to *"Combo memory troubleshooting"*.
NOK
Flash again.

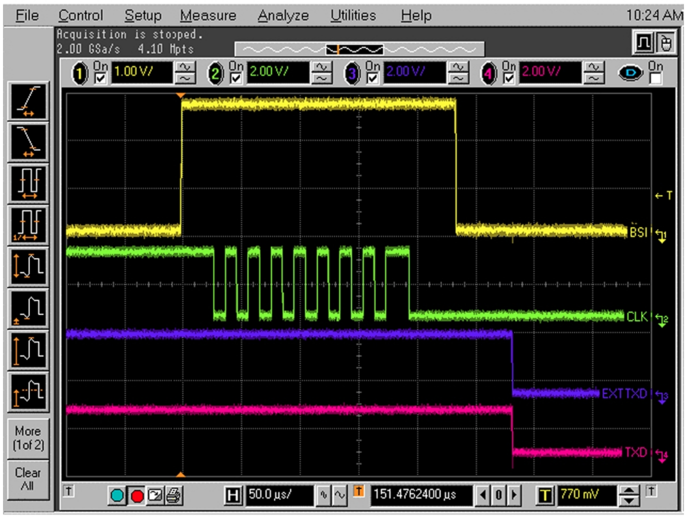

File
Control
Setup
Measure
Analyze
Utilities
Help
10:24 AM
Acquisition is stopped.
2.00 GSa/s 4.10 Mpts
On
1.00 V/
2.00 V/
2.00 V/
2.00 V/
BSI
CLK
EXTTXD
TXD
More (1of 2)
Clear All
50.0 µs/
151.4762400 µs
770 mV

Figure 8 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

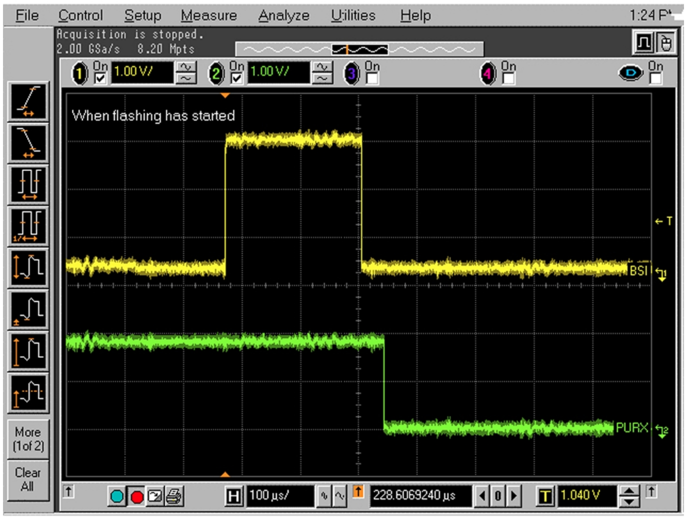
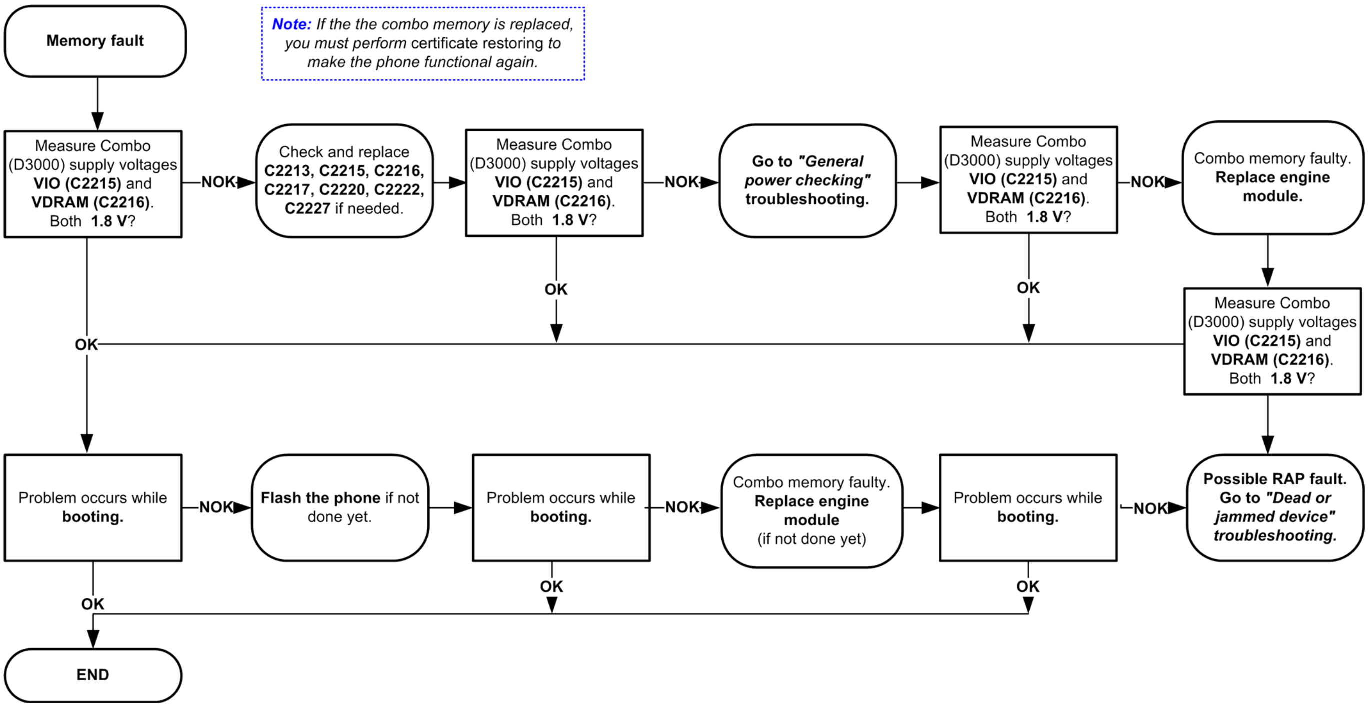

File
Control
Setup
Measure
Analyze
Utilities
Help
1:24 P
Acquisition is stopped.
2.00 GSa/s 8.20 Mpts
1.00 V/
1.00 V/
When flashing has started
BSI
PURX
T
More (1of 2)
Clear All
100 µs/
228.6069240 µs
1.040 V

Figure 9 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

Combo memory troubleshooting

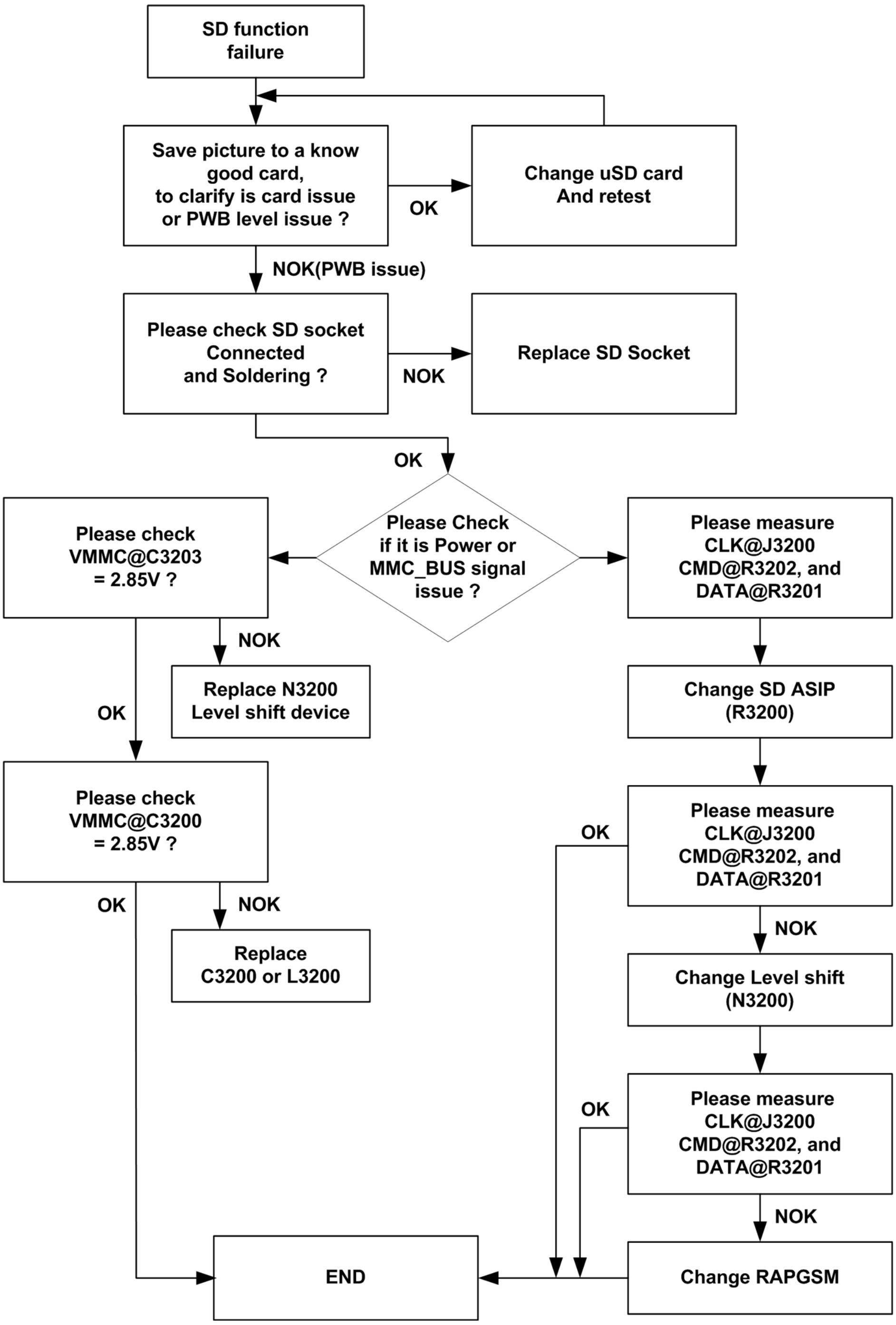
Troubleshooting flow

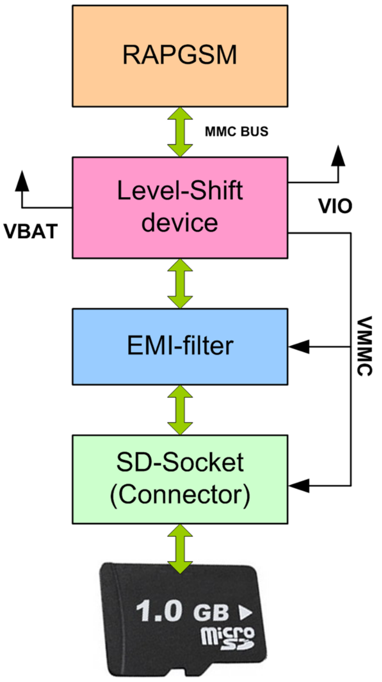

Note: If the the combo memory is replaced, you must perform certificate restoring to make the phone functional again.

Memory fault
Measure Combo (D3000) supply voltages VIO (C2215) and VDRAM (C2216). Both 1.8 V?
NOK
Check and replace C2213, C2215, C2216, C2217, C2220, C2222, C2227 if needed.
Measure Combo (D3000) supply voltages VIO (C2215) and VDRAM (C2216). Both 1.8 V?
NOK
Go to "General power checking" troubleshooting.
Measure Combo (D3000) supply voltages VIO (C2215) and VDRAM (C2216). Both 1.8 V?
NOK
Combo memory faulty. Replace engine module.
Measure Combo (D3000) supply voltages VIO (C2215) and VDRAM (C2216). Both 1.8 V?
OK
OK
OK
Problem occurs while booting.
NOK
Flash the phone if not done yet.
Problem occurs while booting.
NOK
Combo memory faulty. Replace engine module (if not done yet)
Problem occurs while booting.
NOK
Possible RAP fault. Go to "Dead or jammed device" troubleshooting.
OK
OK
OK
END

SD card troubleshooting

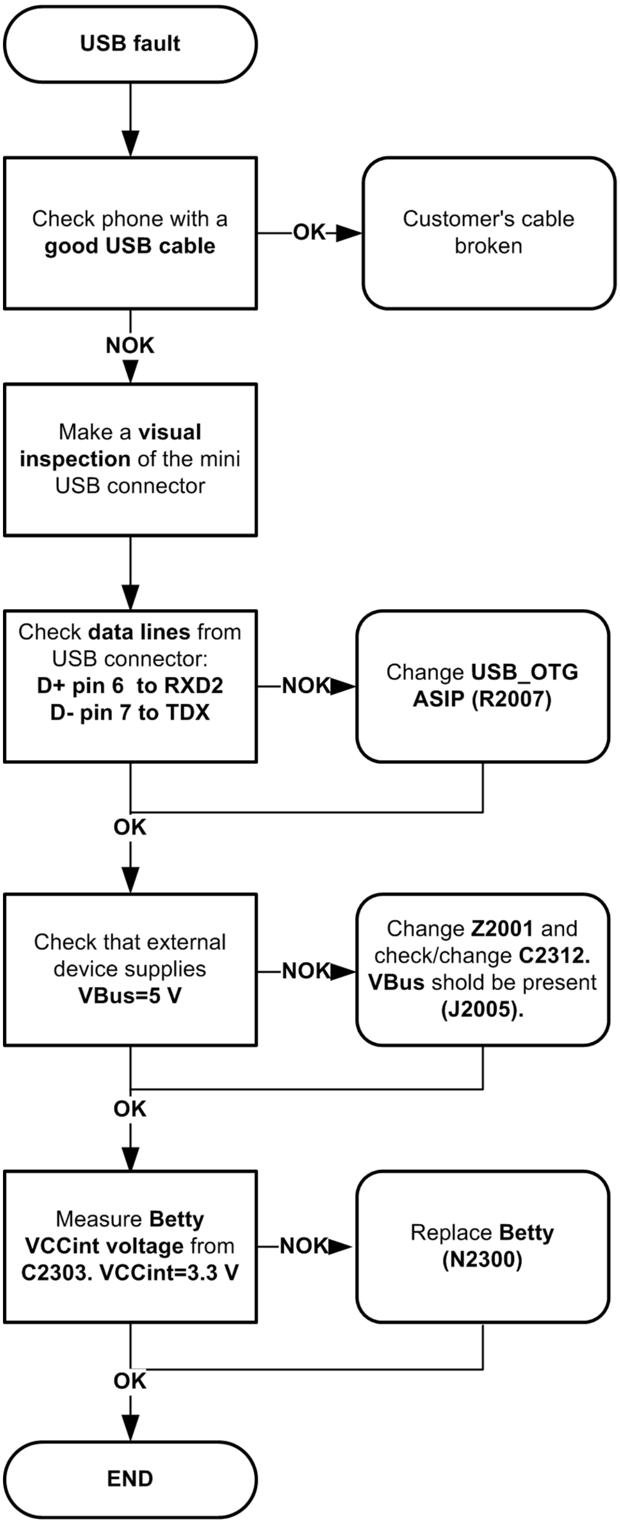
Troubleshooting flow

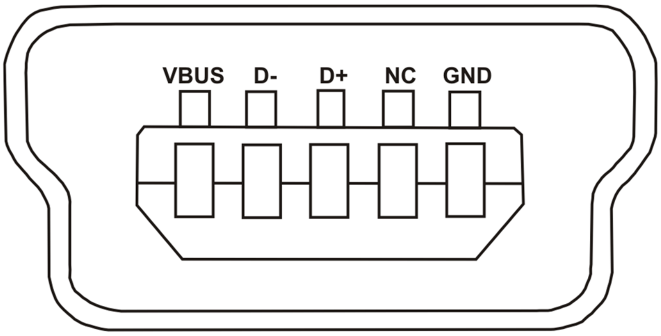

SD function failure
Save picture to a know good card, to clarify is card issue or PWB level issue ?
OK
Change uSD card And retest
NOK(PWB issue)
Please check SD socket Connected and Soldering ?
NOK
Replace SD Socket
OK
Please Check if it is Power or MMC_BUS signal issue ?
Please check VMMC@C3203 = 2.85V ?
NOK
Replace N3200 Level shift device
OK
Please check VMMC@C3200 = 2.85V ?
OK
NOK
Replace C3200 or L3200
Please measure CLK@J3200 CMD@R3202, and DATA@R3201
Change SD ASIP (R3200)
OK
Please measure CLK@J3200 CMD@R3202, and DATA@R3201
NOK
Change Level shift (N3200)
OK
Please measure CLK@J3200 CMD@R3202, and DATA@R3201
NOK
Change RAPGSM
END


RAPGSM
MMC BUS
Level-Shift device
VBAT
VIO
EMI-filter
VMMC
SD-Socket (Connector)
1.0 GB
micro SD

USB interface troubleshooting

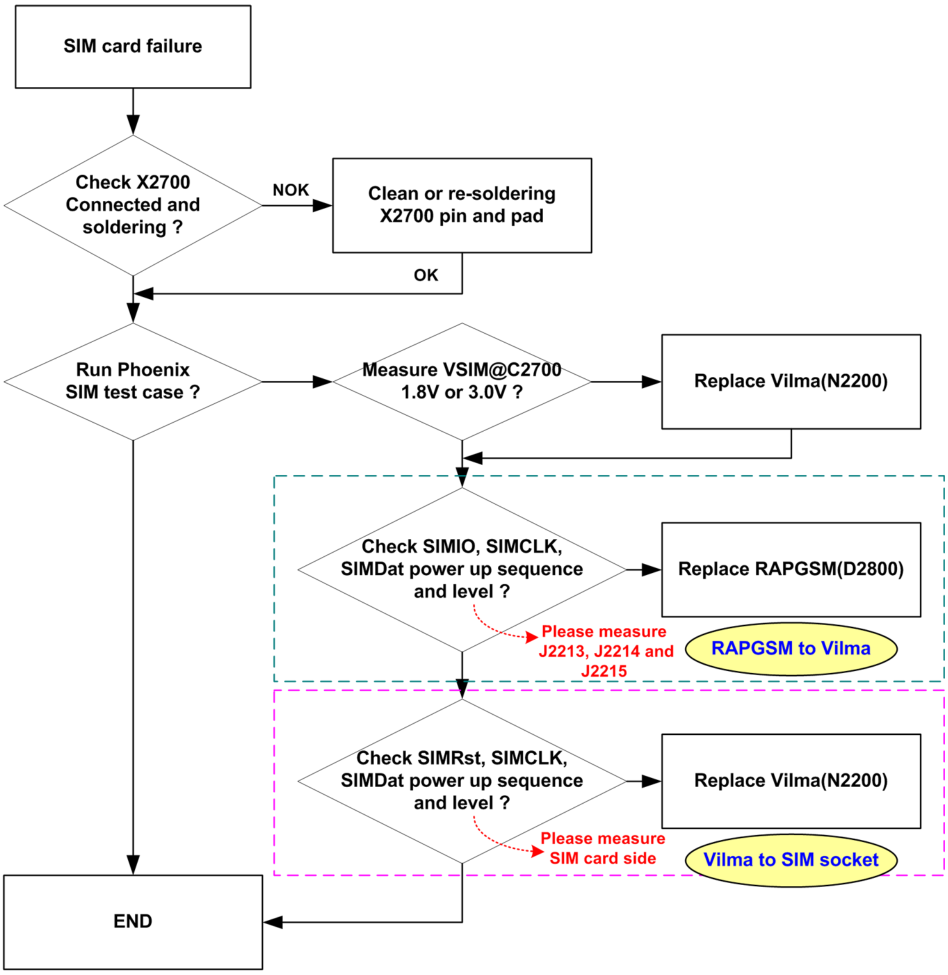
Troubleshooting flow

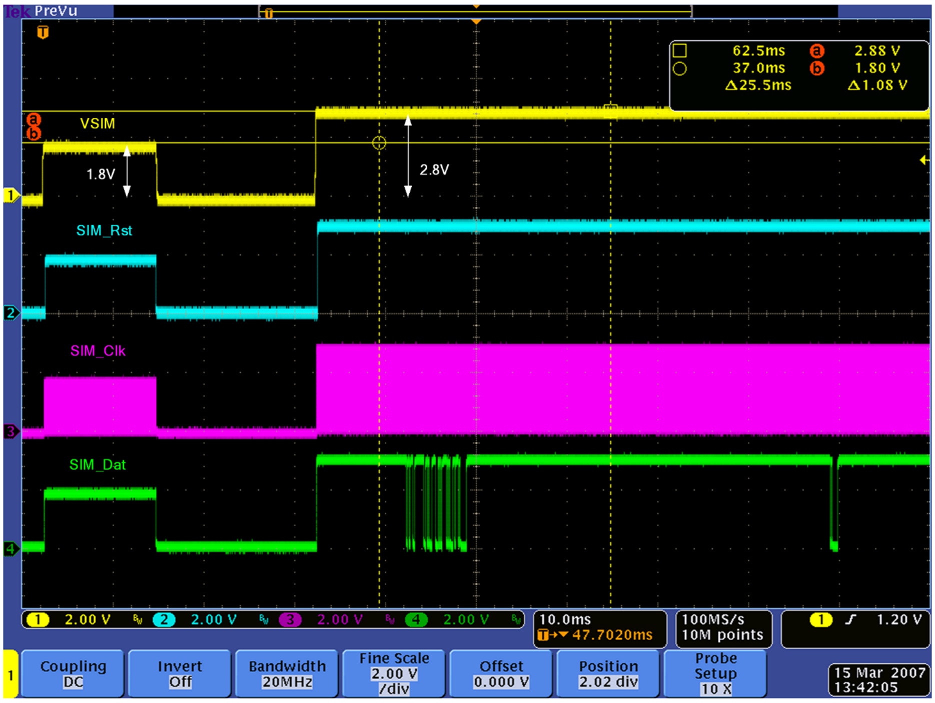

USB fault
Check phone with a good USB cable
OK
Customer's cable broken
NOK
Make a visual inspection of the mini USB connector
Check data lines from USB connector: D+ pin 6 to RXD2 D- pin 7 to TDX
NOK
Change USB_OTG ASIP (R2007)
OK
Check that external device supplies VBus=5 V
NOK
Change Z2001 and check/change C2312. VBus shold be present (J2005).
OK
Measure Betty VCCint voltage from C2303. VCCint=3.3 V
NOK
Replace Betty (N2300)
OK
END


VBUS
D-
D+
NC
GND

SIM card troubleshooting

Troubleshooting flow


SIM card failure
Check X2700 Connected and soldering ?
NOK
Clean or re-soldering X2700 pin and pad
OK
Run Phoenix SIM test case ?
Measure VSIM@C2700 1.8V or 3.0V ?
Replace Vilma(N2200)
Check SIMIO, SIMCLK, SIMDat power up sequence and level ?
Replace RAPGSM(D2800)
Please measure J2213, J2214 and J2215
RAPGSM to Vilma
Check SIMRst, SIMCLK, SIMDat power up sequence and level ?
Replace Vilma(N2200)
Please measure SIM card side
Vilma to SIM socket
END



User interface troubleshooting

Keypad, side and media keys troubleshooting

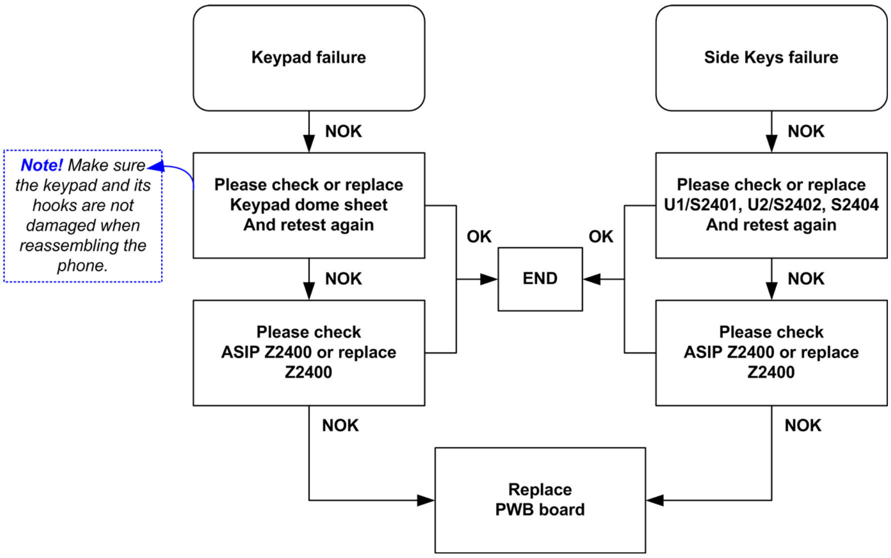
Context

There are two possible failure modes in the keyboard module:

- One or more keys are stuck, so that the key does not react when a keydome or a side key is pressed. This kind of failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.)
- Malfunction of several keys at the same time; this happens when one or more rows or columns in the key matrix are failing (shortcut or open connection).

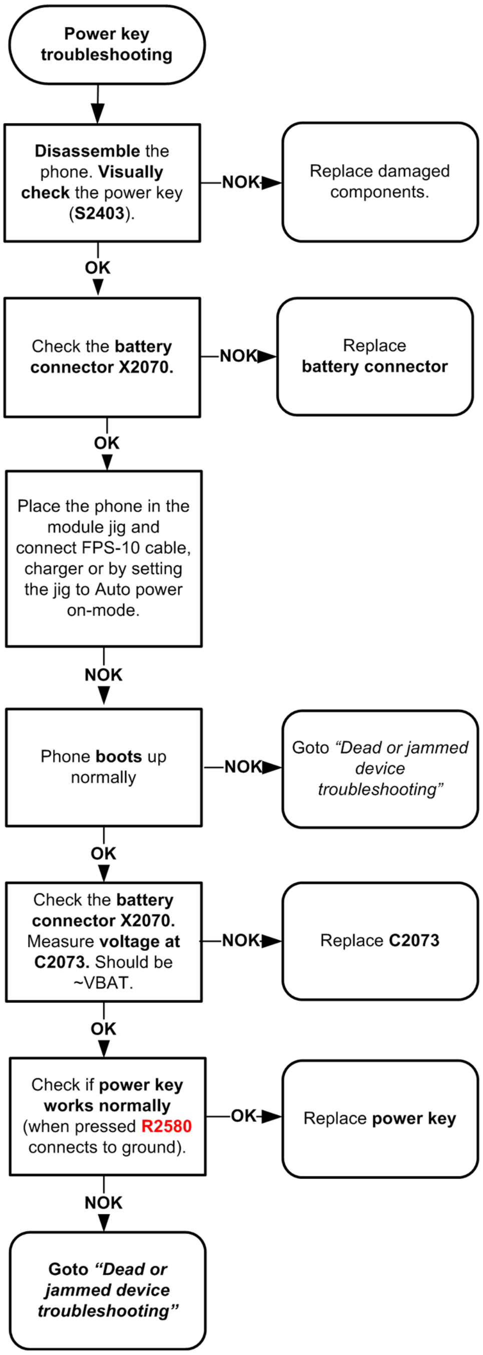
If the failure mode is not clear, start with the Keyboard test in Phoenix.

Troubleshooting flow


Keypad failure
Side Keys failure
NOK
NOK
Note! Make sure the keypad and its hooks are not damaged when reassembling the phone.
Please check or replace Keypad dome sheet And retest again
Please check or replace U1/S2401, U2/S2402, S2404 And retest again
OK
OK
END
NOK
NOK
Please check ASIP Z2400 or replace Z2400
Please check ASIP Z2400 or replace Z2400
NOK
NOK
Replace PWB board

Power key troubleshooting

Troubleshooting flow


Power key troubleshooting
Disassemble the phone. Visually check the power key (S2403).
NOK
Replace damaged components.
OK
Check the battery connector X2070.
NOK
Replace battery connector
OK
Place the phone in the module jig and connect FPS-10 cable, charger or by setting the jig to Auto power on-mode.
NOK
Phone boots up normally
NOK
Goto "Dead or jammed device troubleshooting"
OK
Check the battery connector X2070. Measure voltage at C2073. Should be ~VBAT.
NOK
Replace C2073
OK
Check if power key works normally (when pressed R2580 connects to ground).
OK
Replace power key
NOK
Goto "Dead or jammed device troubleshooting"

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.

- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 1 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 2 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.
2. Check that the cellular engine is working normally.
   - i To check the functionality, connect the phone to a docking station.
   - ii Start *Phoenix* service software.
   - iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).

3. Proceed to the display troubleshooting flowcharts.

   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

Context

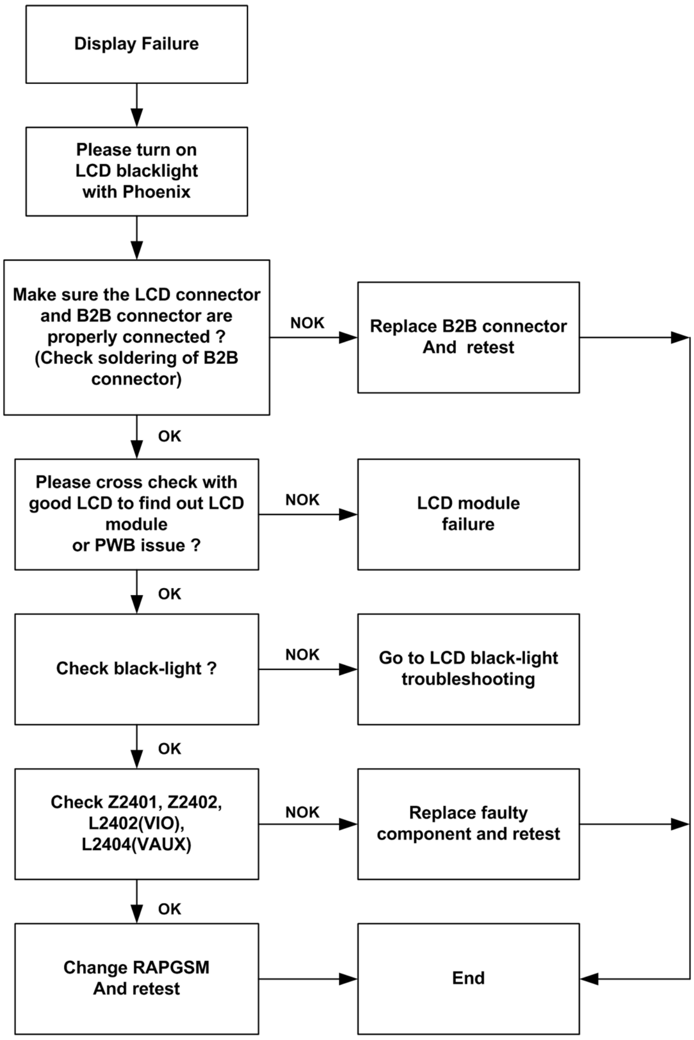
There are three different display fault cases;

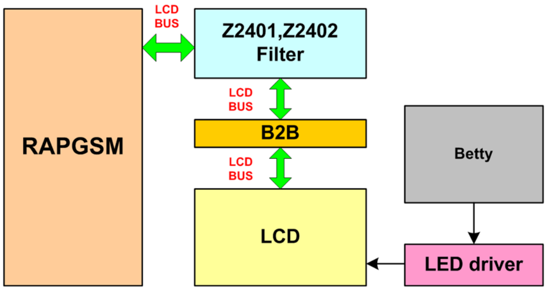
1 No backlights when image is on

2 No image when backlight is on

3 No backlight and no image

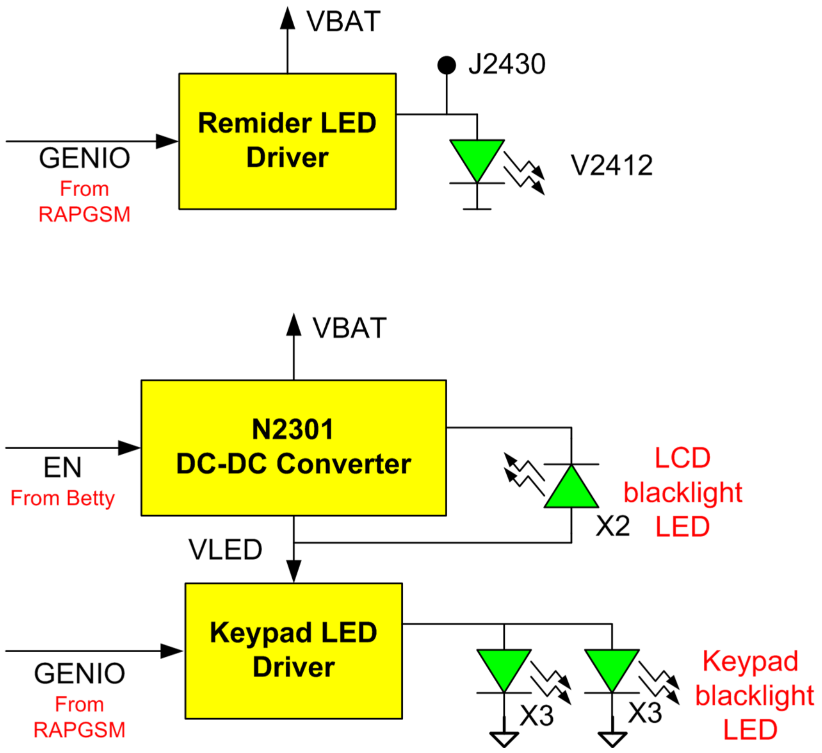
Troubleshooting flow


Display Failure
Please turn on LCD blacklight with Phoenix
Make sure the LCD connector and B2B connector are properly connected ? (Check soldering of B2B connector)
NOK
Replace B2B connector And retest
OK
Please cross check with good LCD to find out LCD module or PWB issue ?
NOK
LCD module failure
OK
Check black-light ?
NOK
Go to LCD black-light troubleshooting
OK
Check Z2401, Z2402, L2402(VIO), L2404(VAUX)
NOK
Replace faulty component and retest
OK
Change RAPGSM And retest
End


RAPGSM
LCD BUS
Z2401,Z2402 Filter
LCD BUS
B2B
LCD BUS
LCD
Betty
LED driver

Backlight troubleshooting

Troubleshooting flow

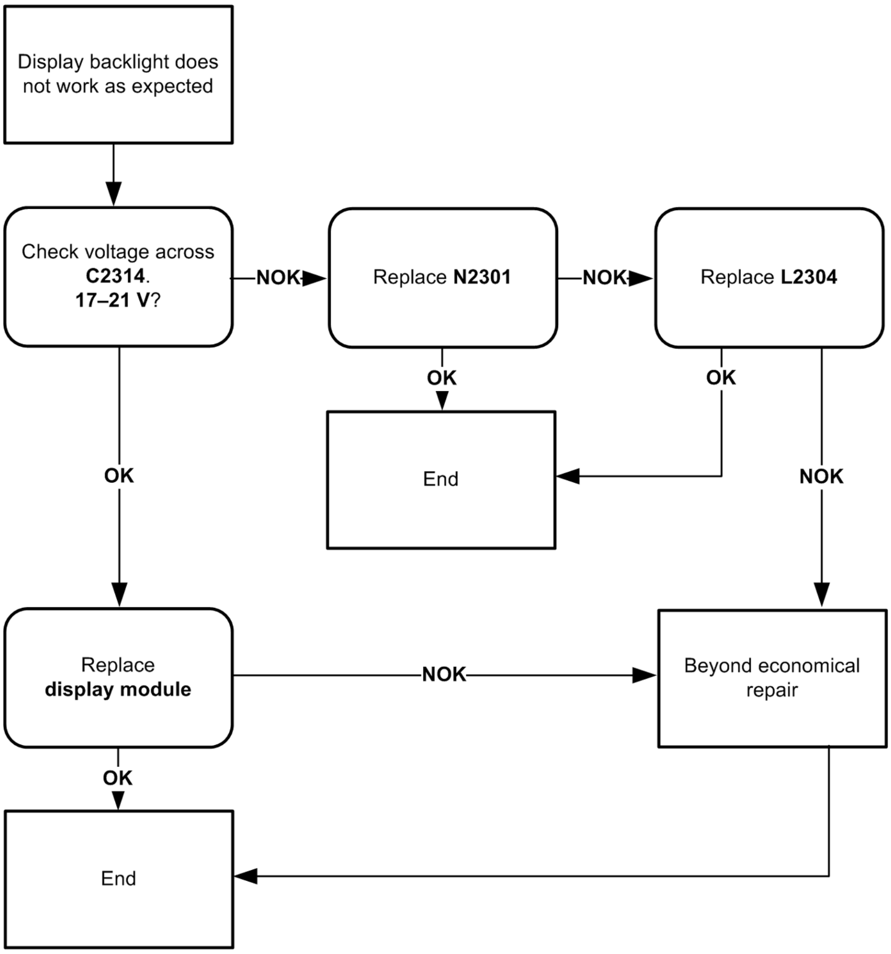

VBAT
J2430
Remider LED Driver
GENIO
From RAPGSM
V2412
VBAT
N2301
DC-DC Converter
EN
From Betty
LCD blacklight LED
X2
VLED
Keypad LED Driver
GENIO
From RAPGSM
X3
X3
Keypad blacklight LED

LED driver troubleshooting

Context

This device has one LED driver providing current for diaplsy and keypad.

Troubleshooting flow


Display backlight does not work as expected
Check voltage across C2314. 17–21 V?
NOK
Replace N2301
NOK
Replace L2304
OK
OK
End
OK
NOK
Replace display module
NOK
Beyond economical repair
OK
End

Camera module troubleshooting

Introduction to camera troubleshooting

Bad conditions often cause bad pictures. Therefore, the camera operation has to be checked in constant conditions or by using a second, known-to-be-good Nokia device as reference. Image quality is hard to measure quantitatively, and the difference between a good and a bad picture can be small. Some training or experience may be needed to detect what is actually wrong.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems are common:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Taking and evaluating test pictures with main camera

When *taking* a test picture, remember the following:

- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- If the phone is hot, let it rest for a while before taking the picture
- Make sure the optical system is clean

- Use highest possible resolution
- Make sure the light is sufficient (bright office lightning)
- Do not take the picture towards light source
- Hold the phone as still as possible when taking the picture
- Pictures should be taken both at infinity ~>2m and at macro distance ~10-15 cm in order to verify auto focus functionality

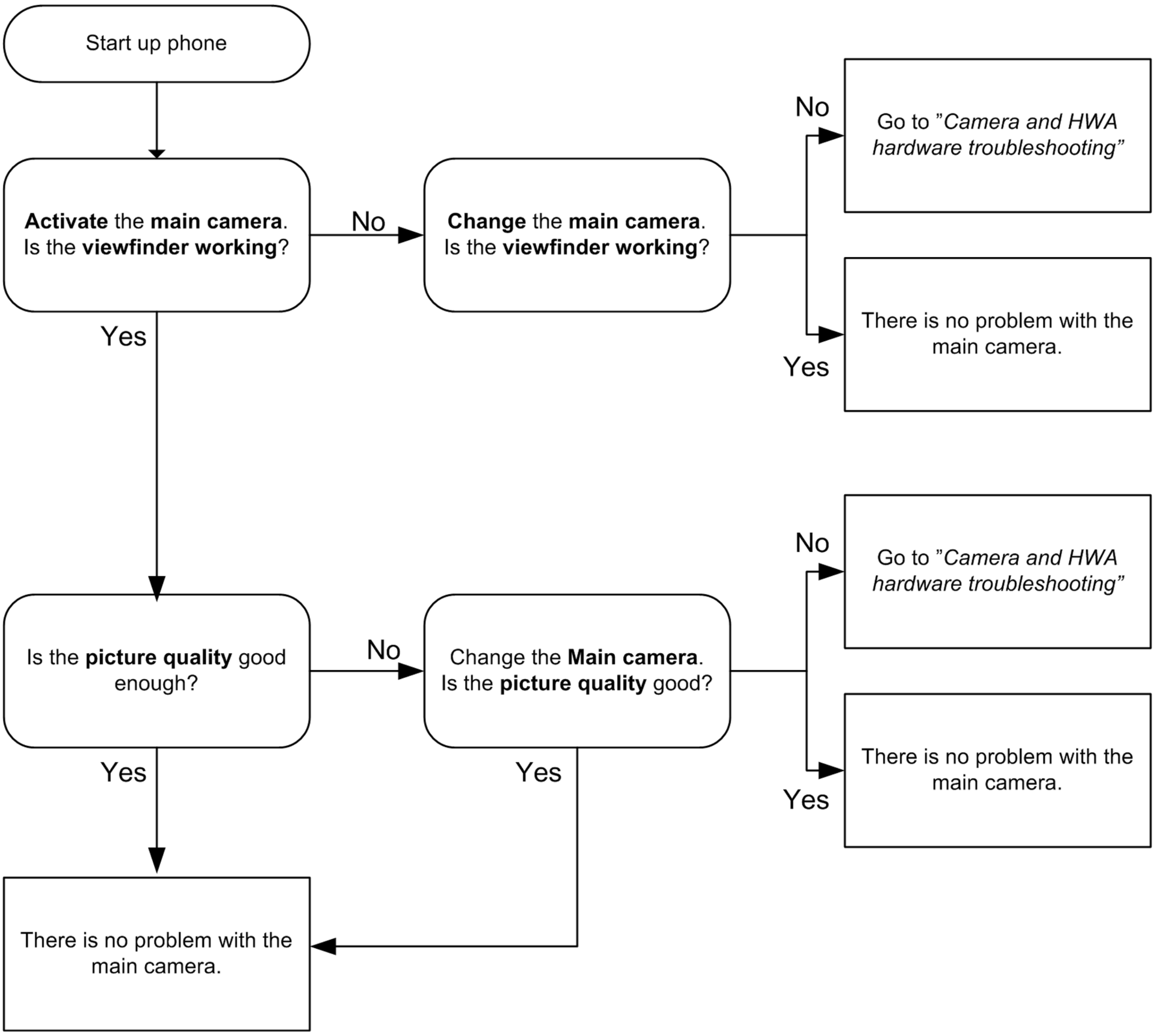
When *evaluating* a test picture, remember the following:

- The center of the picture is sharper than the edges
- If phone has auto focus: Remember that the white focussing frame which appears when the camera button is pressed halfway down, must turn green for auto focus lock. If the frame turns red, the camera is not focussed!
- The image may be blurred, though it does not show in the viewfinder
- Analyse the picture from your PC monitor, full colour setting is recommended
- If possible, compare with a picture of the same motive taken with a similar Nokia device

Camera troubleshooting

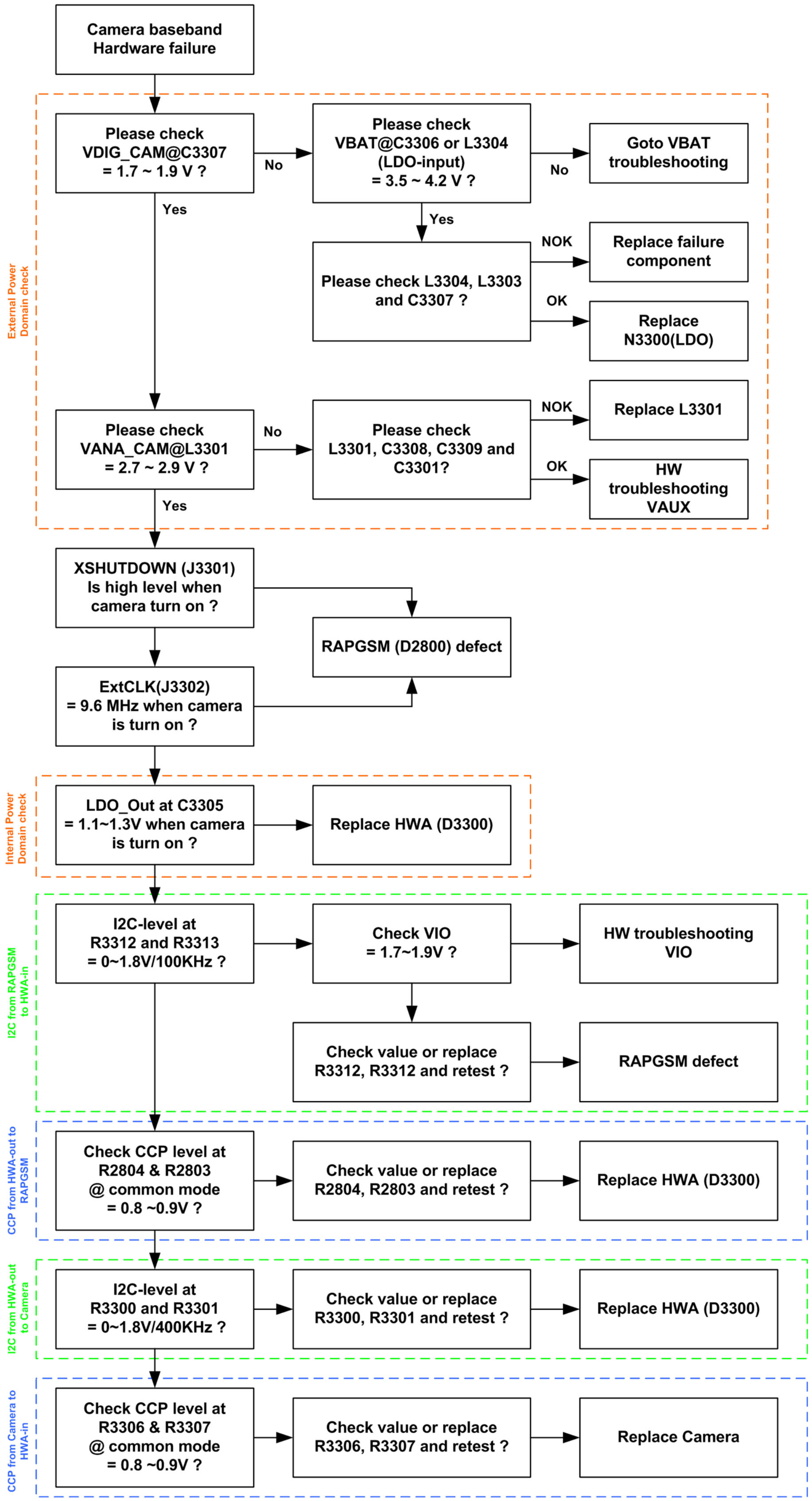
Camera troubleshooting

Troubleshooting flow


Start up phone
Activate the **main camera**. Is the **viewfinder working**?
No
Change the **main camera**. Is the **viewfinder working**?
No
Go to "*Camera and HWA hardware troubleshooting*"
Yes
There is no problem with the main camera.
Yes
Is the **picture quality** good enough?
No
Change the **Main camera**. Is the **picture quality** good?
No
Go to "*Camera and HWA hardware troubleshooting*"
Yes
There is no problem with the main camera.
Yes
Yes
There is no problem with the main camera.

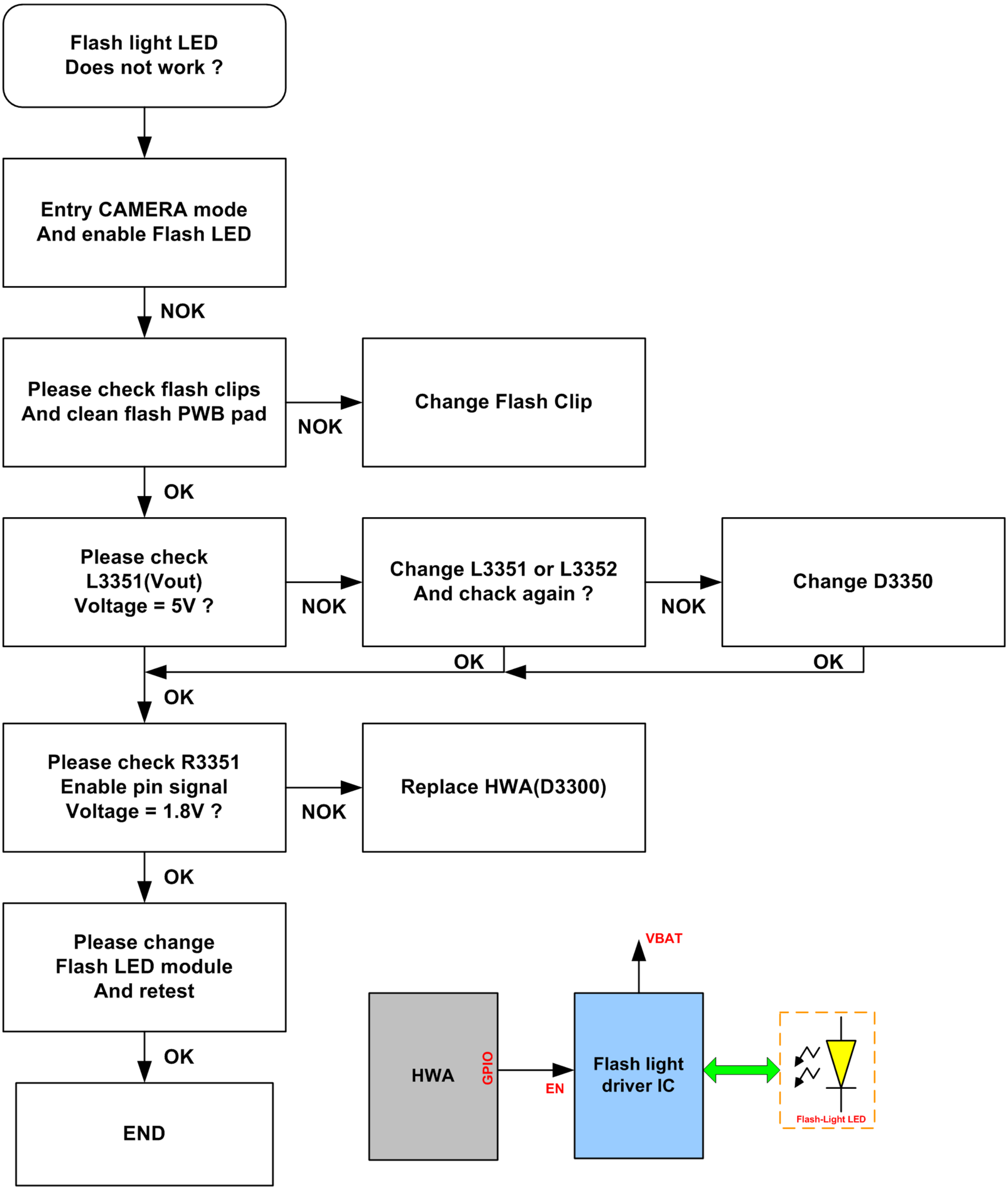
Camera and HWA hardware troubleshooting

Troubleshooting flow


Camera baseband Hardware failure
External Power Domain check
Please check VDIG_CAM@C3307 = 1.7 ~ 1.9 V ?
No
Please check VBAT@C3306 or L3304 (LDO-input) = 3.5 ~ 4.2 V ?
No
Goto VBAT troubleshooting
Yes
Yes
NOK
Replace failure component
Please check L3304, L3303 and C3307 ?
OK
Replace N3300(LDO)
NOK
Replace L3301
Please check VANA_CAM@L3301 = 2.7 ~ 2.9 V ?
No
Please check L3301, C3308, C3309 and C3301?
OK
HW troubleshooting VAUX
Yes
XSHUTDOWN (J3301) Is high level when camera turn on ?
RAPGSM (D2800) defect
ExtCLK(J3302) = 9.6 MHz when camera is turn on ?
Internal Power Domain check
LDO_Out at C3305 = 1.1~1.3V when camera is turn on ?
Replace HWA (D3300)
I2C from RAPGSM to HWA-in
I2C-level at R3312 and R3313 = 0~1.8V/100KHz ?
Check VIO = 1.7~1.9V ?
HW troubleshooting VIO
Check value or replace R3312, R3312 and retest ?
RAPGSM defect
CCP from HWA-out to RAPGSM
Check CCP level at R2804 & R2803 @ common mode = 0.8 ~0.9V ?
Check value or replace R2804, R2803 and retest ?
Replace HWA (D3300)
I2C from HWA-out to Camera
I2C-level at R3300 and R3301 = 0~1.8V/400KHz ?
Check value or replace R3300, R3301 and retest ?
Replace HWA (D3300)
CCP from Camera to HWA-in
Check CCP level at R3306 & R3307 @ common mode = 0.8 ~0.9V ?
Check value or replace R3306, R3307 and retest ?
Replace Camera

LED camera flash troubleshooting

Troubleshooting flow


Flash light LED
Does not work ?
Entry CAMERA mode
And enable Flash LED
NOK
Please check flash clips
And clean flash PWB pad
NOK
Change Flash Clip
OK
Please check
L3351(Vout)
Voltage = 5V ?
NOK
Change L3351 or L3352
And chack again ?
NOK
Change D3350
OK
OK
OK
Please check R3351
Enable pin signal
Voltage = 1.8V ?
NOK
Replace HWA(D3300)
OK
Please change
Flash LED module
And retest
OK
END
VBAT
HWA
GPIO
EN
Flash light
driver IC
Flash-Light LED

Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- 'Active speaker' or 'speaker and power amplifier'
- Sound level meter
- Current probe (Internal handsfree DPMA output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2102 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	B2102 pads					
Internal Mic to External Earpiece	B2100 (OUT/GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					
		HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Measurement data

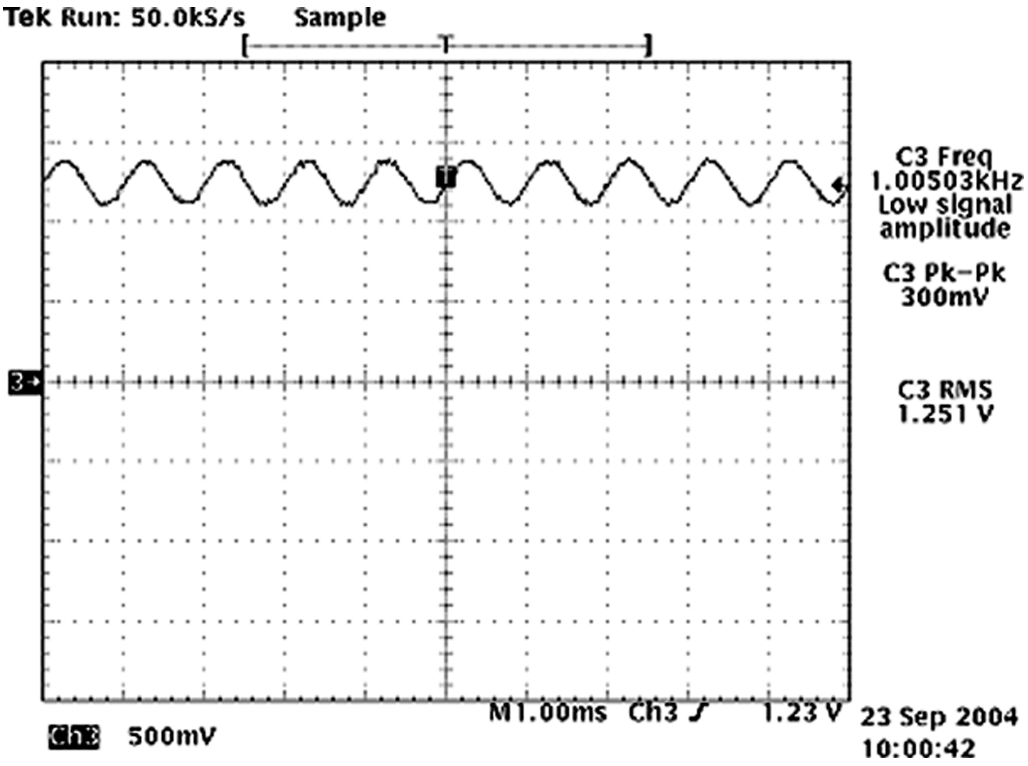
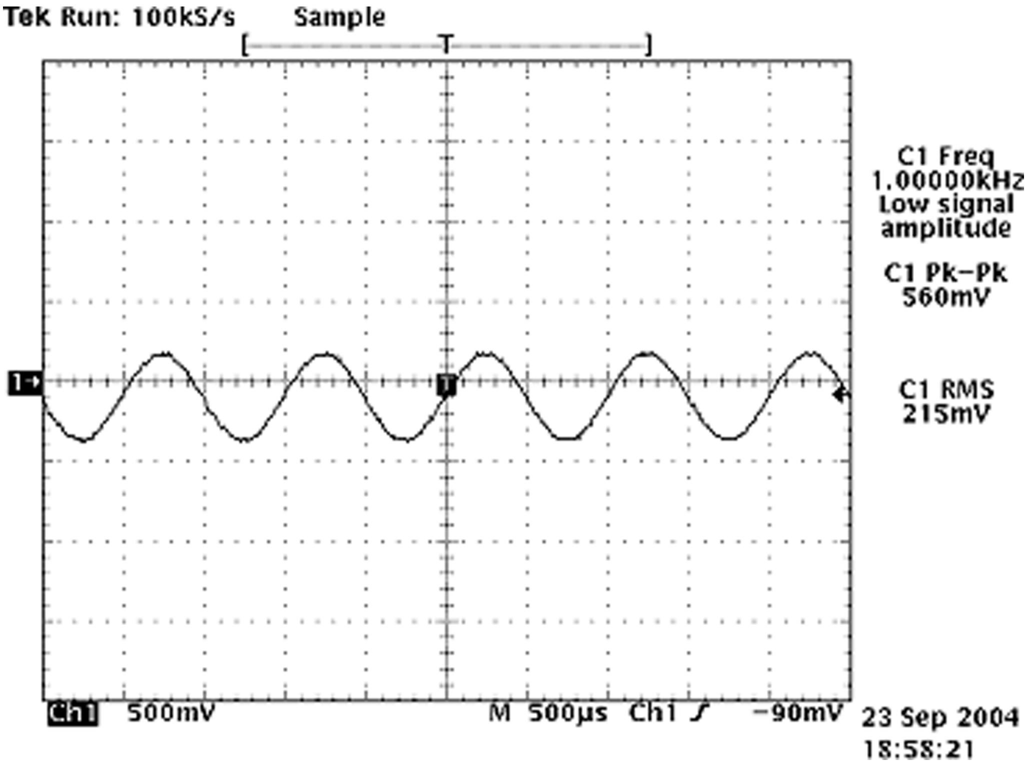


Figure 10 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



If a special low-pass filter designed for measuring digital amplifiers is unavailable, the measurement must be performed with a current probe and the input signal frequency must be 2kHz.

Figure 11 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

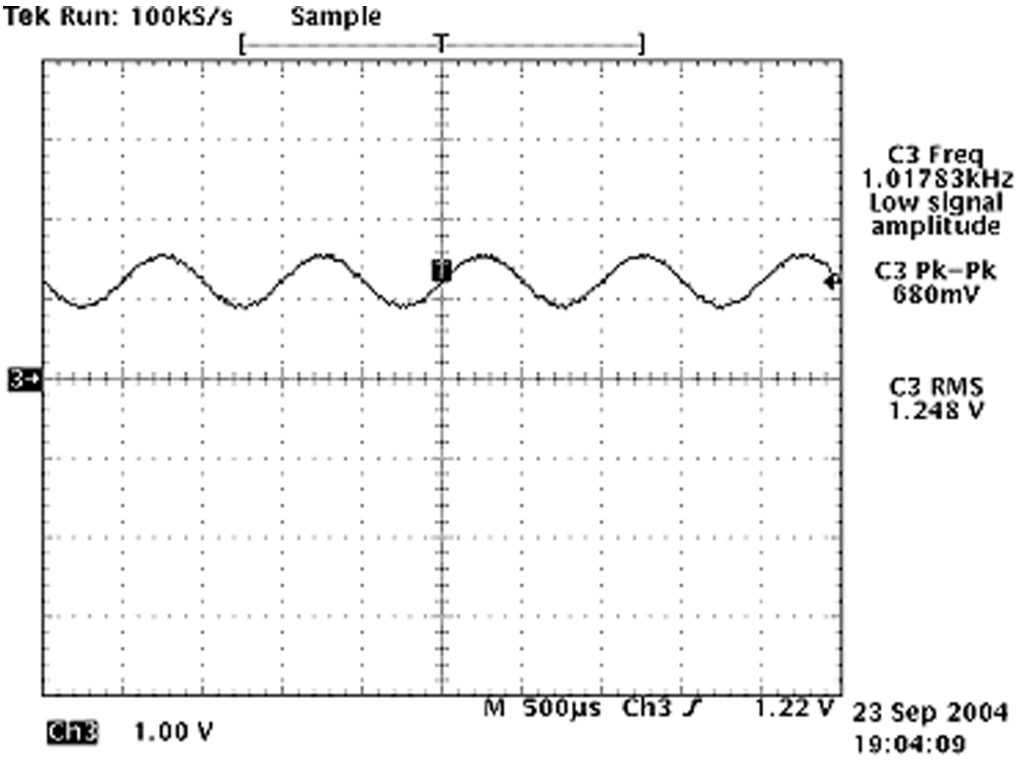

Tek Run: 100kS/s Sample
C3 Freq
1.01783kHz
Low signal
amplitude
C3 Pk-Pk
680mV
C3 RMS
1.248 V
Ch3 1.00 V
M 500µs Ch3 ∫ 1.22 V
23 Sep 2004
19:04:09

Figure 12 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

Internal audio troubleshooting

Internal audio signal flow

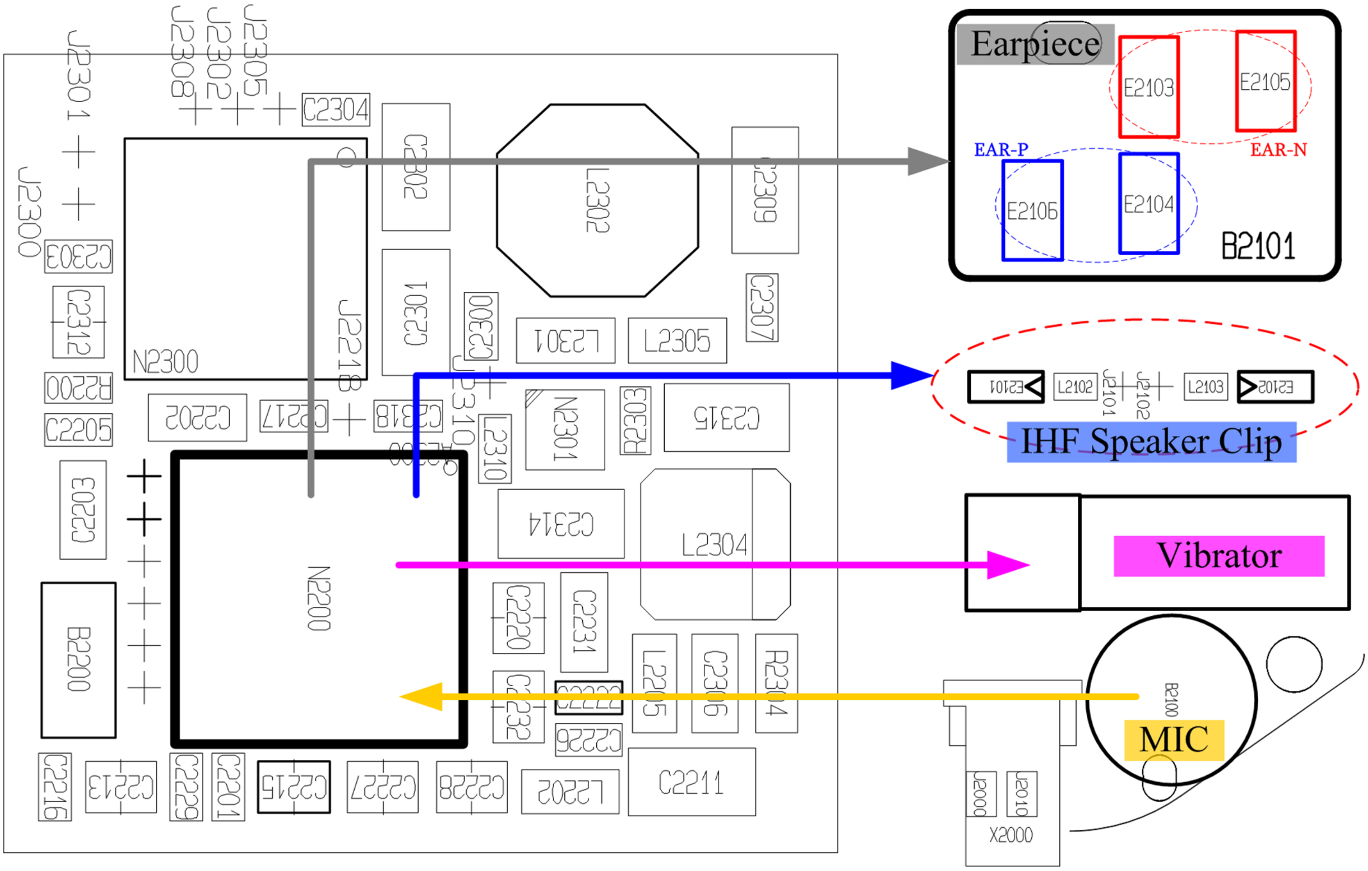
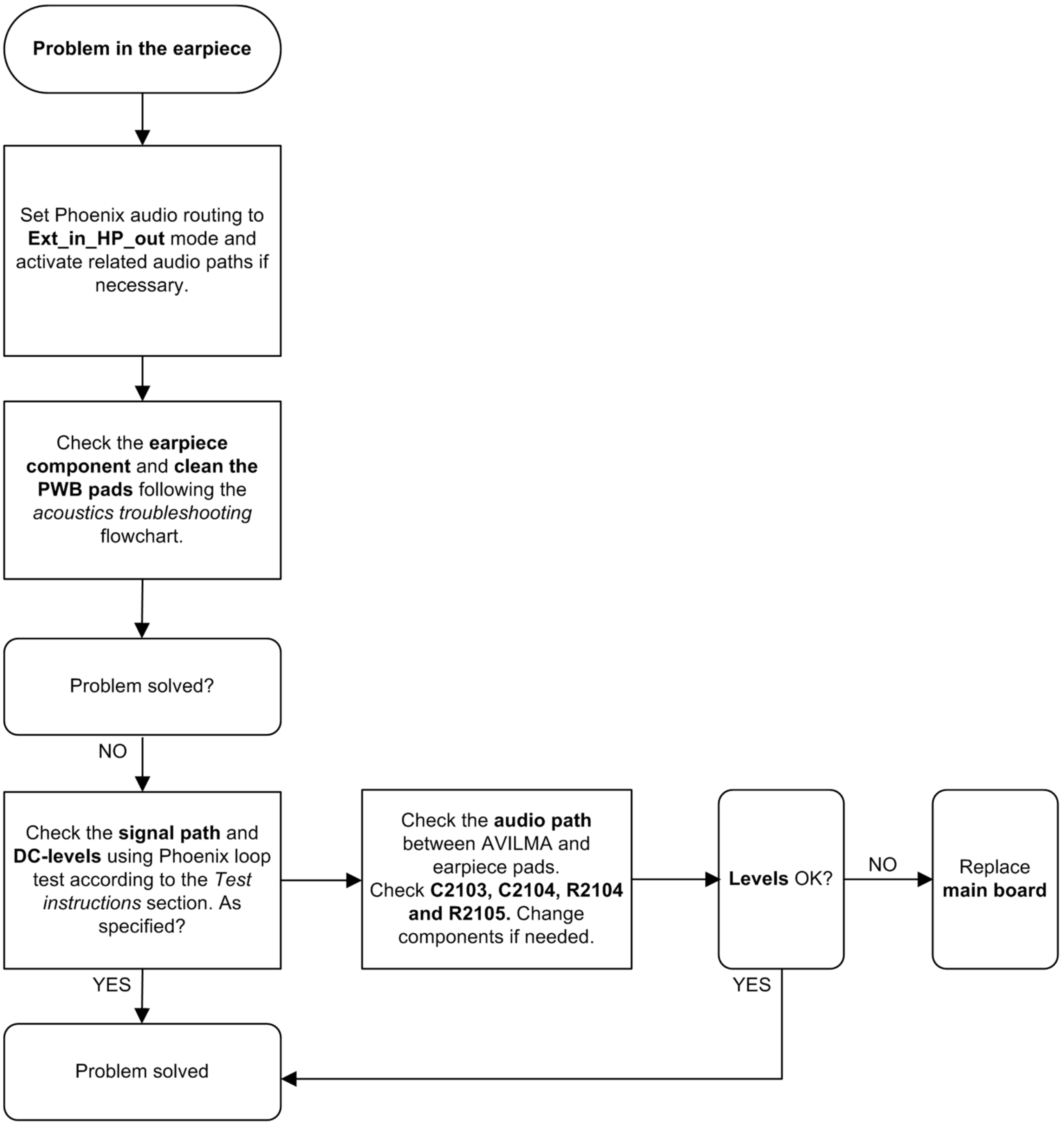
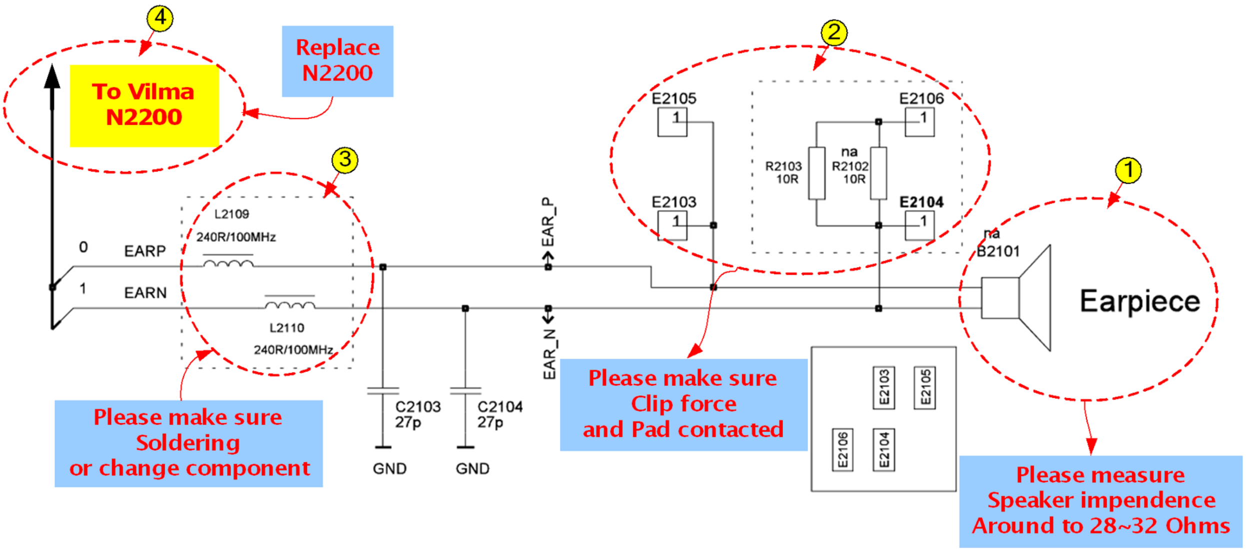

Earpiece
E2103
E2105
EAR-P
EAR-N
E2105
E2104
B2101
IHF Speaker Clip
Vibrator
MIC
N2200
N2300
X2000

Figure 13 Internal audio signal flow

Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece
Set Phoenix audio routing to Ext_in_HP_out mode and activate related audio paths if necessary.
Check the earpiece component and clean the PWB pads following the acoustics troubleshooting flowchart.
Problem solved?
NO
Check the signal path and DC-levels using Phoenix loop test according to the Test instructions section. As specified?
YES
Problem solved
Check the audio path between AVILMA and earpiece pads.
Check C2103, C2104, R2104 and R2105. Change components if needed.
Levels OK?
NO
Replace main board
YES


4
To Vilma N2200
Replace N2200
3
L2109
240R/100MHz
0
EARP
1
EARN
L2110
240R/100MHz
C2103
27p
C2104
27p
GND
GND
EAR_P
EAR_N
2
E2105
E2106
E2103
E2104
R2103
10R
na
R2102
10R
1
na
B2101
Earpiece
E2103
E2105
E2106
E2104

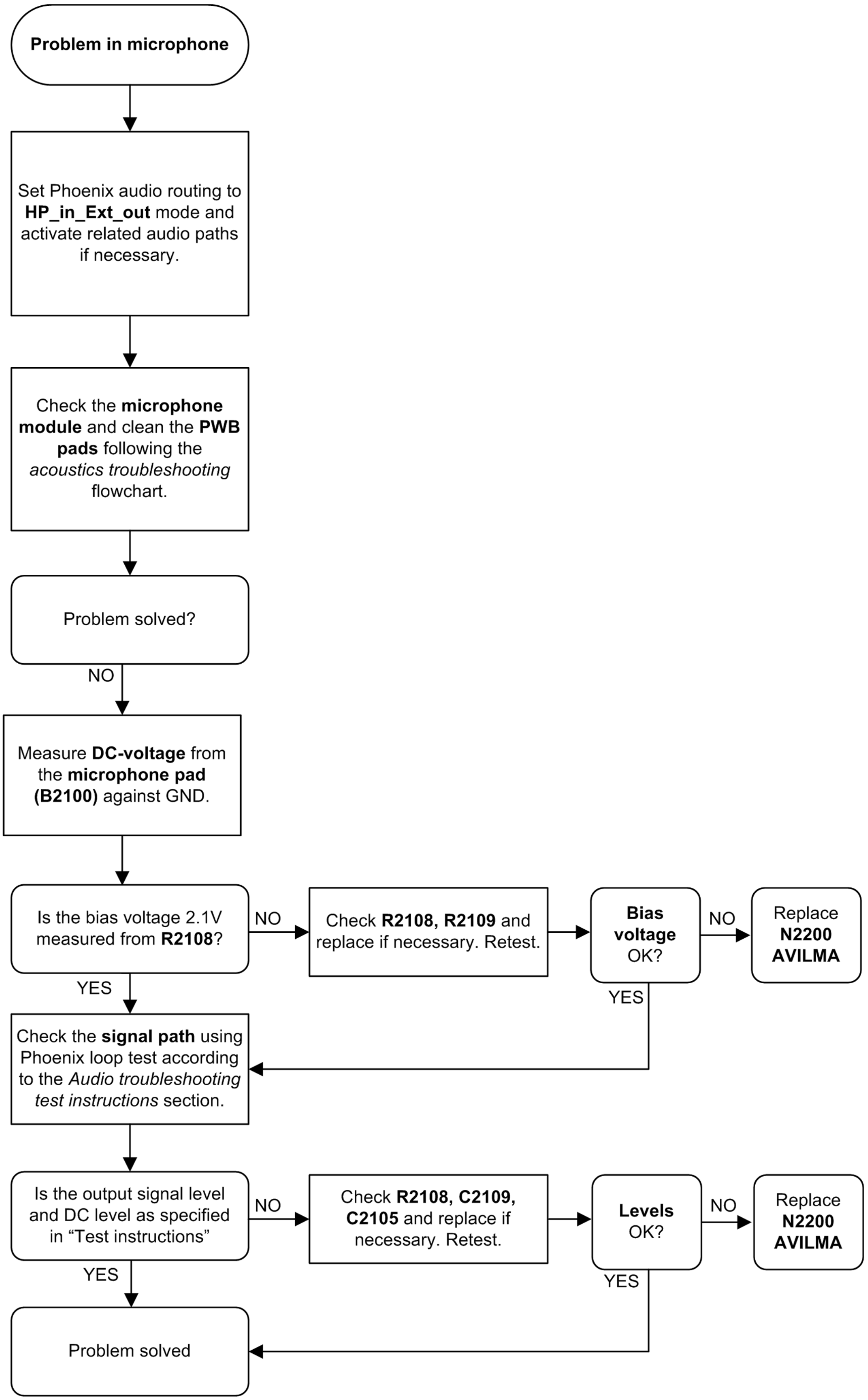
Please make sure Soldering or change component

Please make sure Clip force and Pad contacted

Please measure Speaker impendence Around to 28~32 Ohms

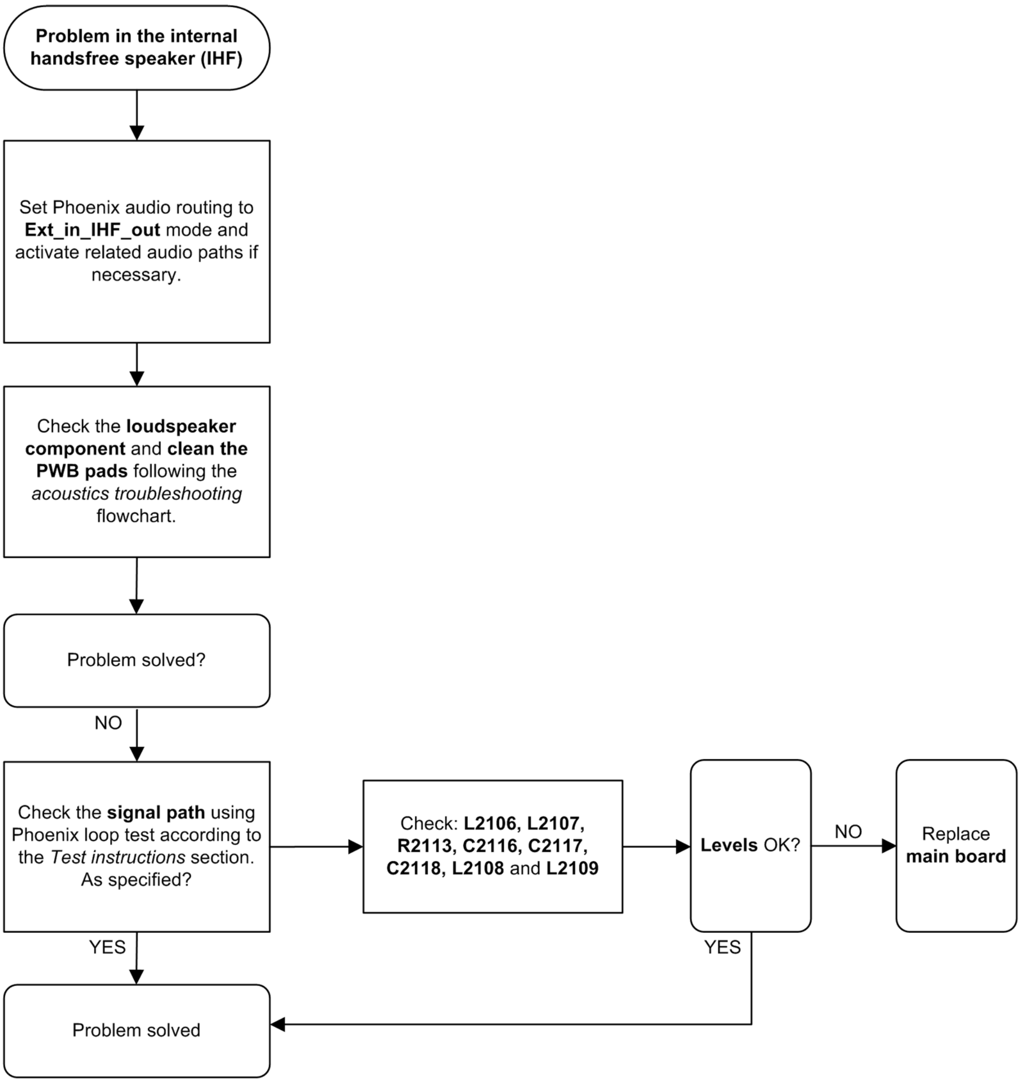
Internal microphone troubleshooting

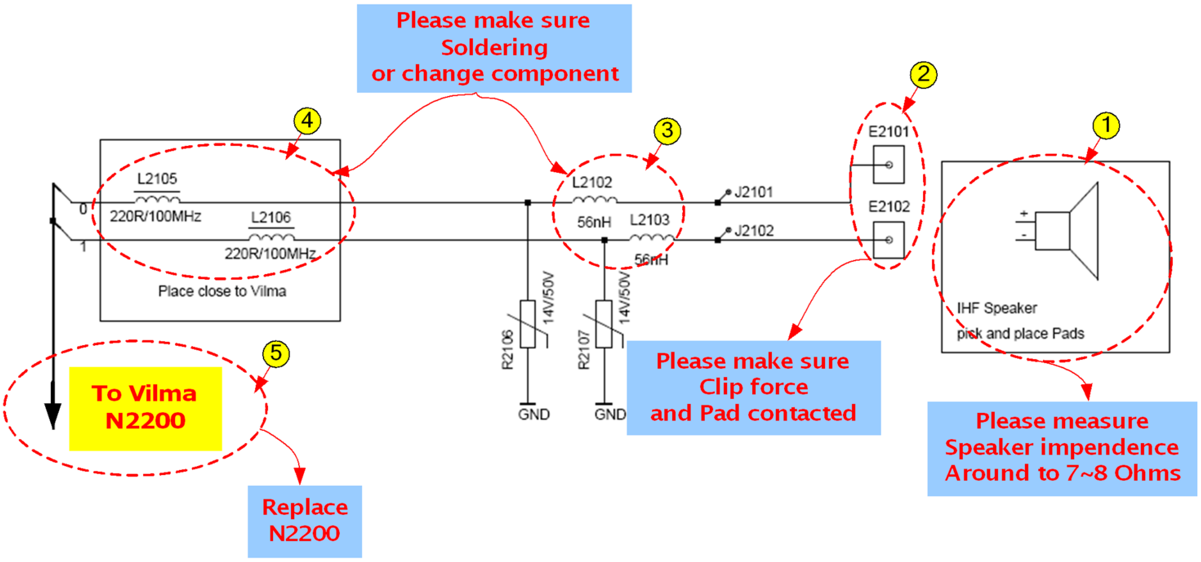
Troubleshooting flow


Problem in microphone
Set Phoenix audio routing to HP_in_Ext_out mode and activate related audio paths if necessary.
Check the microphone module and clean the PWB pads following the acoustics troubleshooting flowchart.
Problem solved?
NO
Measure DC-voltage from the microphone pad (B2100) against GND.
Is the bias voltage 2.1V measured from R2108?
NO
Check R2108, R2109 and replace if necessary. Retest.
Bias voltage OK?
NO
Replace N2200 AVILMA
YES
YES
Check the signal path using Phoenix loop test according to the Audio troubleshooting test instructions section.
Is the output signal level and DC level as specified in "Test instructions"
NO
Check R2108, C2109, C2105 and replace if necessary. Retest.
Levels OK?
NO
Replace N2200 AVILMA
YES
YES
Problem solved

Internal handsfree (IHF) troubleshooting

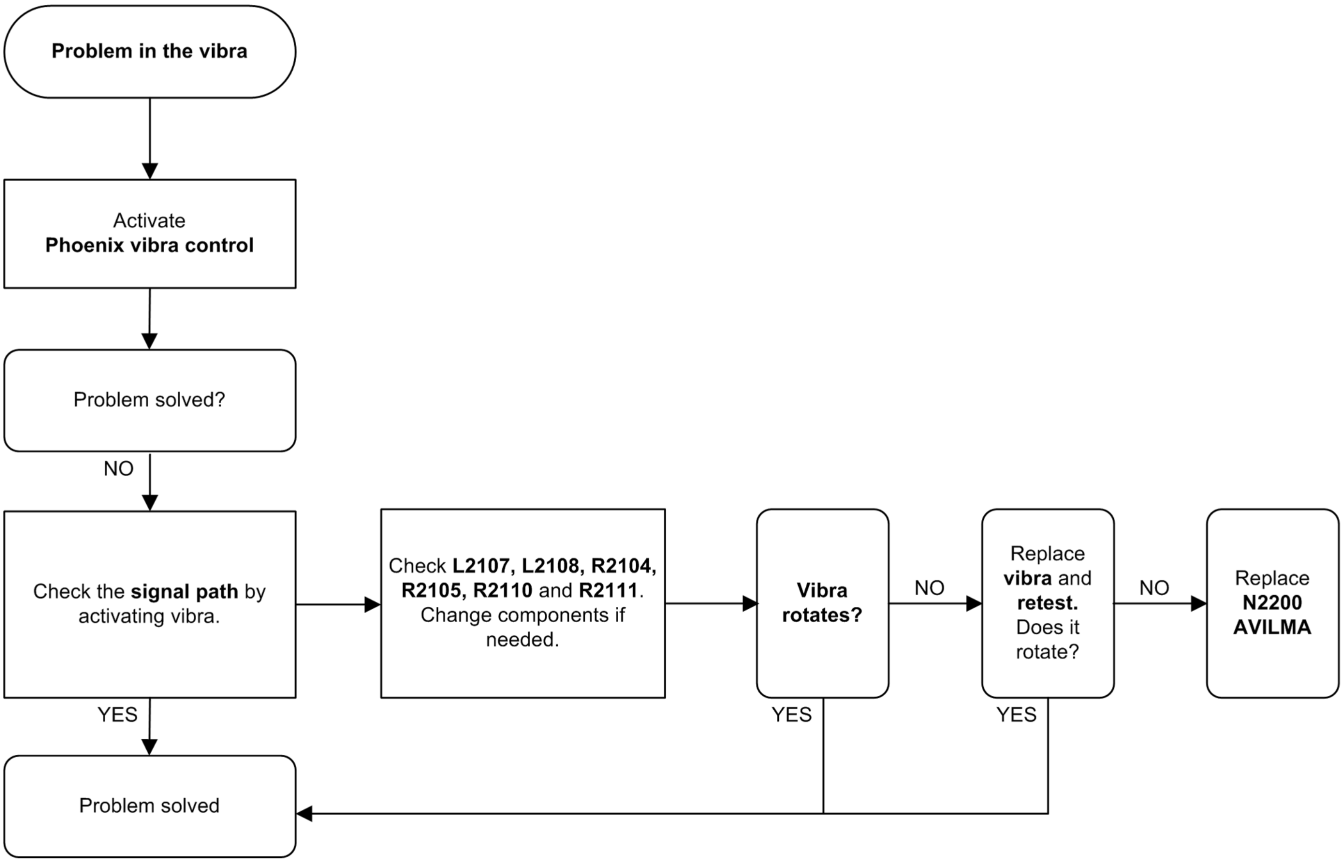
Troubleshooting flow

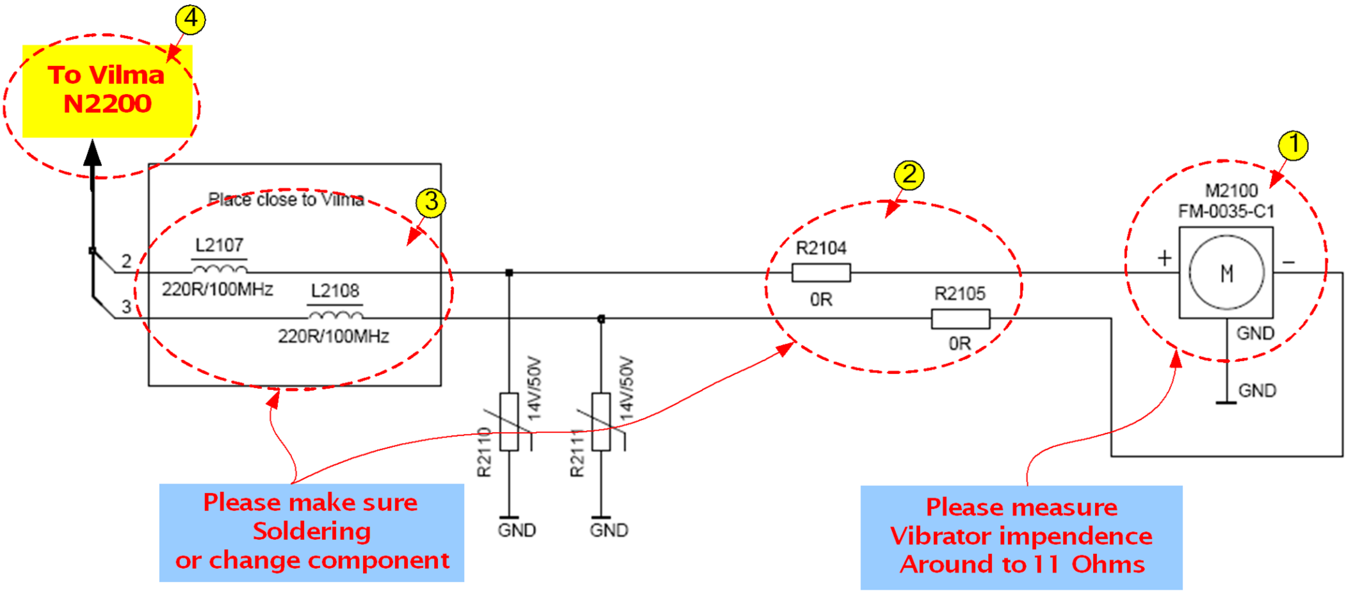

Problem in the internal handsfree speaker (IHF)
Set Phoenix audio routing to Ext_in_IHF_out mode and activate related audio paths if necessary.
Check the loudspeaker component and clean the PWB pads following the acoustics troubleshooting flowchart.
Problem solved?
NO
Check the signal path using Phoenix loop test according to the Test instructions section. As specified?
Check: L2106, L2107, R2113, C2116, C2117, C2118, L2108 and L2109
Levels OK?
NO
Replace main board
YES
YES
Problem solved


Please make sure Soldering or change component
④
③
②
①
L2105
220R/100MHz
L2106
220R/100MHz
Place close to Vilma
0
1
L2102
56nH
L2103
56nH
J2101
J2102
E2101
E2102
R2106
14V/50V
R2107
14V/50V
GND
GND
IHF Speaker
pick and place Pads
⑤
To Vilma N2200
Replace N2200
Please make sure Clip force and Pad contacted
Please measure Speaker impendence Around to 7~8 Ohms

Vibra troubleshooting

Troubleshooting flow


Problem in the vibra
Activate
Phoenix vibra control
Problem solved?
NO
Check the signal path by activating vibra.
YES
Problem solved
Check L2107, L2108, R2104, R2105, R2110 and R2111. Change components if needed.
Vibra rotates?
NO
YES
Replace vibra and retest. Does it rotate?
NO
YES
Replace N2200 AVILMA


4
To Vilma
N2200
3
Place close to Vilma
L2107
220R/100MHz
L2108
220R/100MHz
2
3
R2110
14V/50V
R2111
14V/50V
GND
GND
2
R2104
0R
R2105
0R
1
M2100
FM-0035-C1
+
M
–
GND
GND

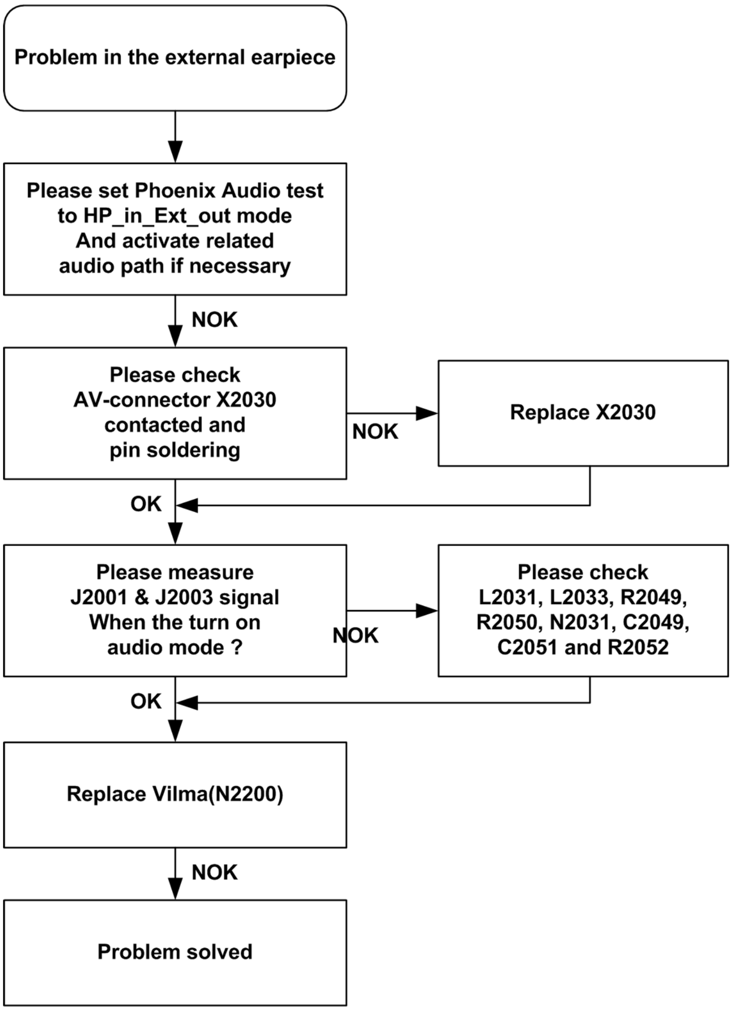
Please make sure Soldering or change component

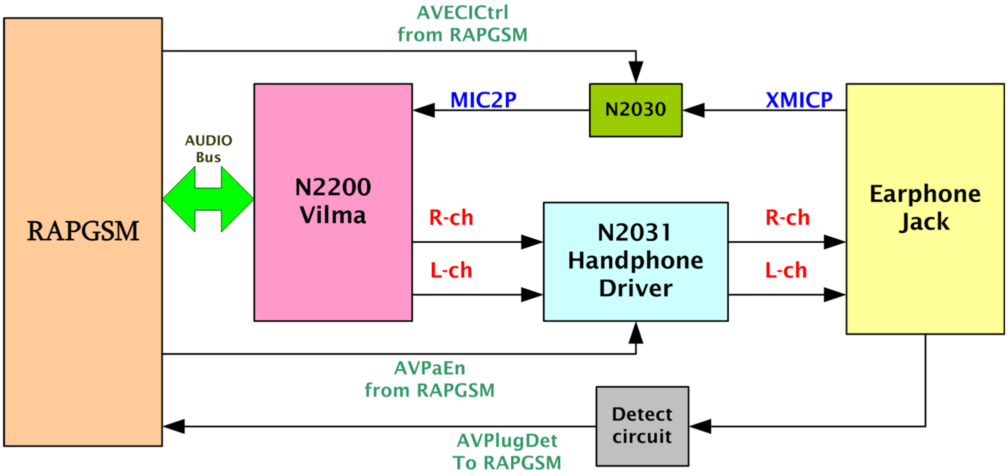
Please measure Vibrator impendence Around to 11 Ohms

External (headset) audio troubleshooting

External earpiece troubleshooting

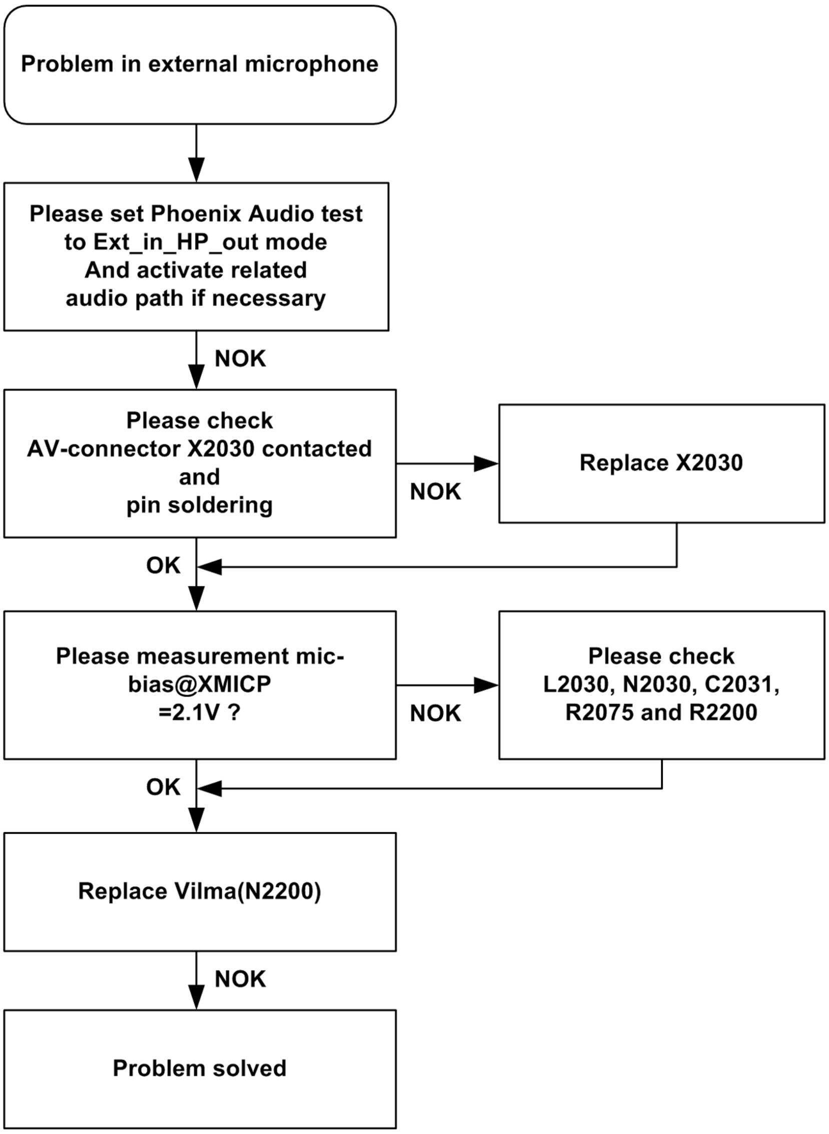
Troubleshooting flow

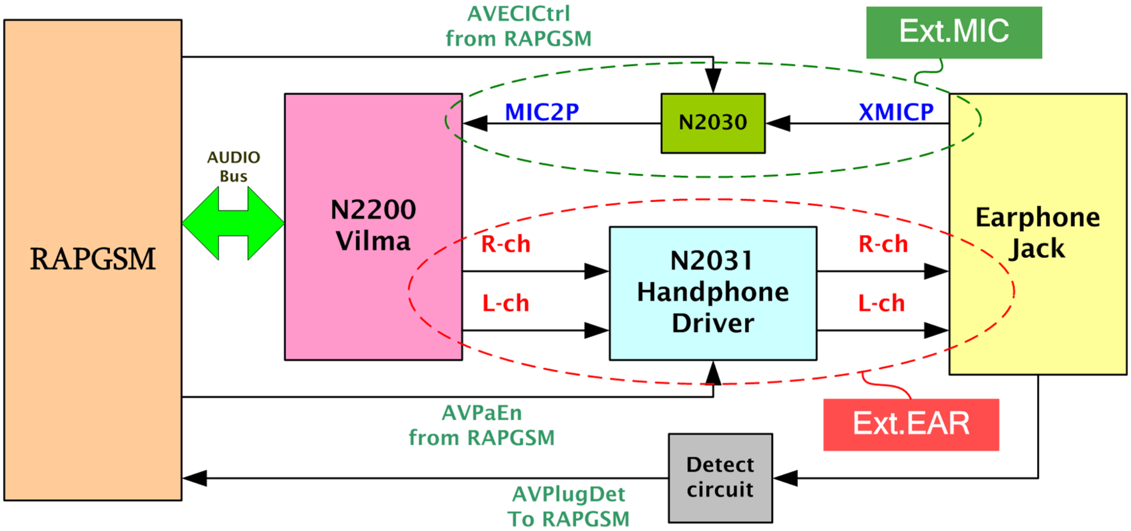

Problem in the external earpiece
Please set Phoenix Audio test to HP_in_Ext_out mode And activate related audio path if necessary
NOK
Please check AV-connector X2030 contacted and pin soldering
NOK
Replace X2030
OK
Please measure J2001 & J2003 signal When the turn on audio mode ?
NOK
Please check L2031, L2033, R2049, R2050, N2031, C2049, C2051 and R2052
OK
Replace Vilma(N2200)
NOK
Problem solved


AVECICtrl from RAPGSM
RAPGSM
AUDIO Bus
N2200 Vilma
MIC2P
N2030
XMICP
Earphone Jack
R-ch
L-ch
N2031 Handphone Driver
R-ch
L-ch
AVPaEn from RAPGSM
Detect circuit
AVPlugDet To RAPGSM

External microphone troubleshooting

Troubleshooting flow


Problem in external microphone
Please set Phoenix Audio test to Ext_in_HP_out mode And activate related audio path if necessary
NOK
Please check AV-connector X2030 contacted and pin soldering
NOK
Replace X2030
OK
Please measurement mic-bias@XMICP =2.1V ?
NOK
Please check L2030, N2030, C2031, R2075 and R2200
OK
Replace Vilma(N2200)
NOK
Problem solved


AVECICtrl from RAPGSM
Ext.MIC
RAPGSM
AUDIO Bus
N2200 Vilma
MIC2P
N2030
XMICP
Earphone Jack
R-ch
L-ch
N2031 Handphone Driver
R-ch
L-ch
Ext.EAR
AVPaEn from RAPGSM
Detect circuit
AVPlugDet To RAPGSM

Baseband manual tuning guide

Certificate restoring for BB5 products

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-8 or FPS-10.

  Note: USB flashing does not work for a dead BB5 phone.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

  Note: SX-4 smart card is needed.
- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2004.39.7.70 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- External smart card reader

  Note: The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.

   i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-8 or FPS-10.

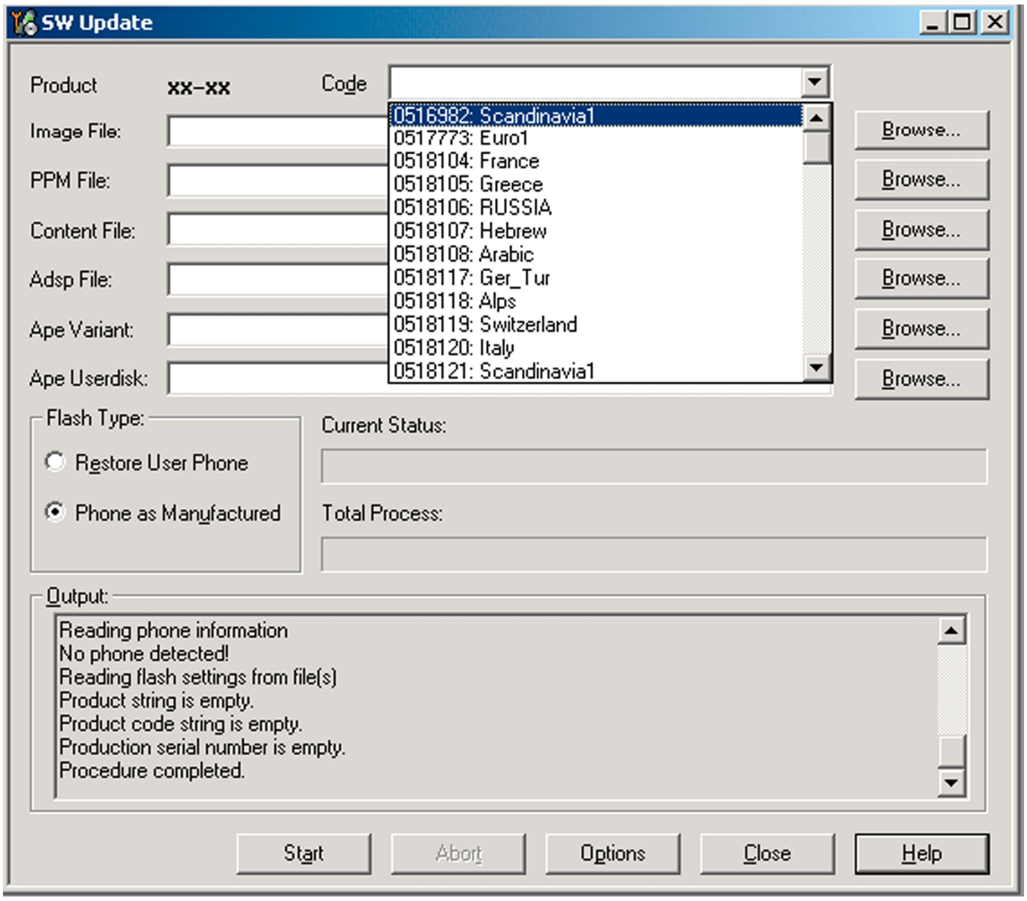
ii Update the phone MCU software to the latest available version.

If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.

iii Choose the product manually from **File→Open Product**, and click **OK**.

Wait for the phone type designator (e.g. "RM-1") to be displayed in the status bar.

iv Go to **Flashing→SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.


SW Update
Image File:
PPM File:
Content File:
Adsp File:
Ape Variant:
Ape Userdisk:
Browse...
Browse...
Browse...
Browse...
Browse...
Browse...
Current Status:
Total Process:
Output:
Start
Abort
Options
Close
Help

Product xx-xx

Code

- 0516982: Scandinavia1
- 0517773: Euro1
- 0518104: France
- 0518105: Greece
- 0518106: RUSSIA
- 0518107: Hebrew
- 0518108: Arabic
- 0518117: Ger_Tur
- 0518118: Alps
- 0518119: Switzerland
- 0518120: Italy
- 0518121: Scandinavia1

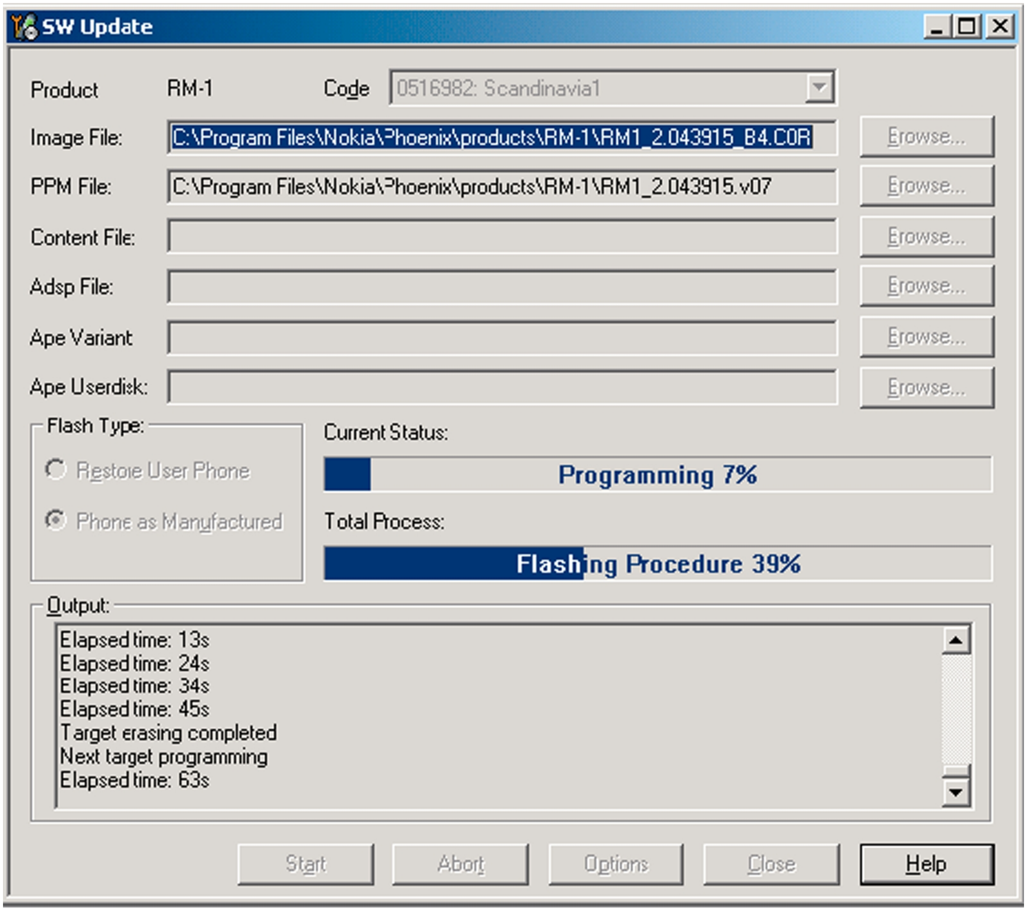
Flash Type:
○ Restore User Phone
● Phone as Manufactured

```
Reading phone information
No phone detected!
Reading flash settings from file(s)
Product string is empty.
Product code string is empty.
Production serial number is empty.
Procedure completed.
```

Product	is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically.
Code	must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.
Flash Type	must be set to **Phone as Manufactured**.

v To continue, click **Start**.

Progress bars and messages on the screen show actions during phone programming, please wait.


SW Update
Content File:
Adsp File:
Ape Variant
Ape Userdisk:
Browse...
Flash Type:
Restore User Phone
Phone as Manufactured
Current Status:
Total Process:
Output:
Start
Abort
Options
Close
Help

Product RM-1 Code 0516982: Scandinavia1

Image File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915_B4.C0R

PPM File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915.v07

Flash Type: ● Phone as Manufactured

Current Status: Programming 7%

Total Process: Flashing Procedure 39%

```
Elapsed time: 13s
Elapsed time: 24s
Elapsed time: 34s
Elapsed time: 45s
Target erasing completed
Next target programming
Elapsed time: 63s
```

Programming is completed when *Flashing Completed* message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *SW Update* window and then choose **File→Close Product** .

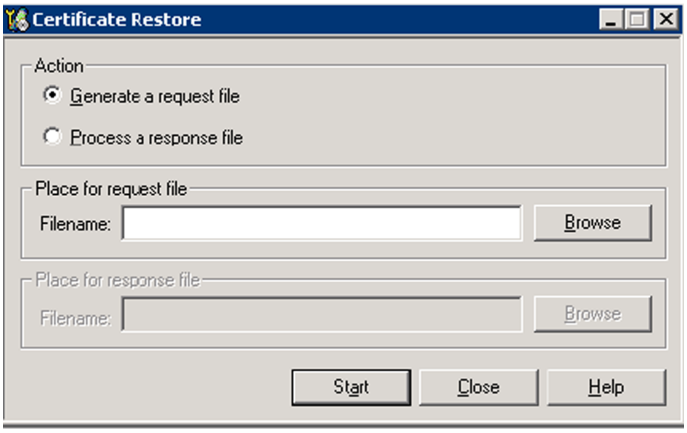
2. Create a *Request* file.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

i To connect the phone with *Phoenix*, choose **File→Scan Product** .

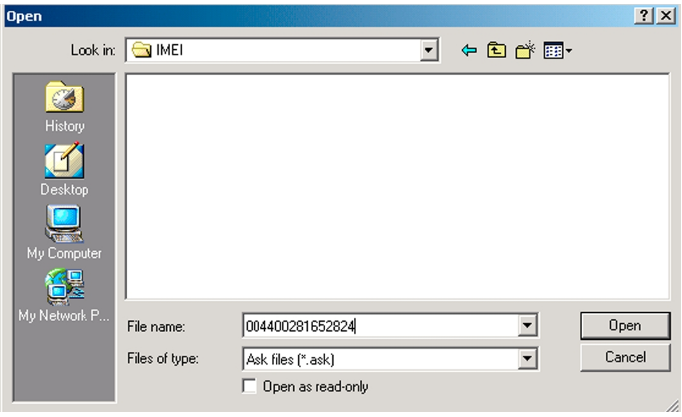
ii Choose **Tools→Certificate Restore** .

iii To choose a location for the request file, click **Browse**.


Certificate Restore
Action
Process a response file
Place for request file
Filename:
Browse
Place for response file
Filename:
Browse
Start
Close
Help

Action: ● Generate a request file

iv Name the file so that you can easily identify it, and click **Open**.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

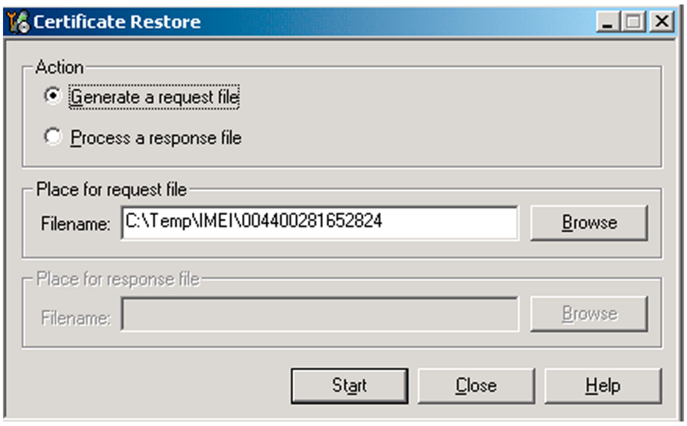
Look in: IMEI

File name: 004400281652824

Files of type: Ask files (*.ask)

☐ Open as read-only

The name of the file and its location are shown.


Certificate Restore
Browse
Browse
Start
Close
Help

Action

● Generate a request file

○ Process a response file

Place for request file

Filename: C:\Temp\IMEI\004400281652824

Place for response file

Filename:

v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

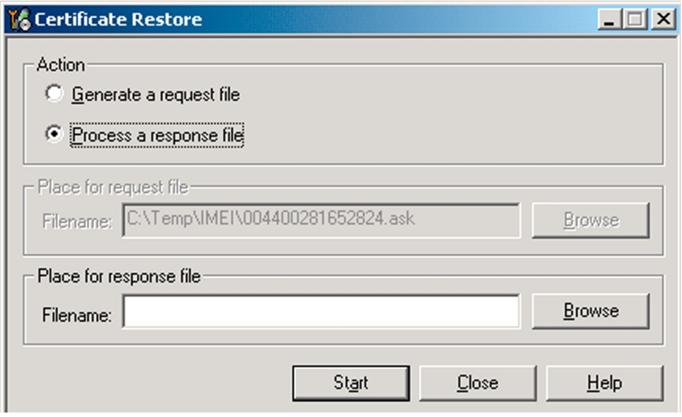
For this procedure, you must supply +12 V to CU-4 from an external power supply.

i Save the reply file sent by Nokia to your computer.

ii Start *Phoenix* service software.

iii Choose **File→Scan Product** .

iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.


Certificate Restore
Action
Place for request file
Place for response file
Browse
Browse
Start
Close
Help

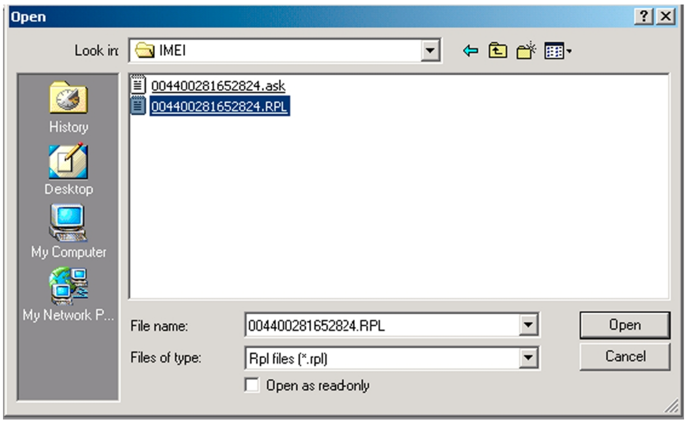
○ Generate a request file
● Process a response file

Filename: C:\Temp\IMEI\004400281652824.ask

Filename:

v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.


Open
History
Desktop
My Computer
My Network P...
004400281652824.ask
004400281652824.RPL
Open
Cancel

Look in: IMEI

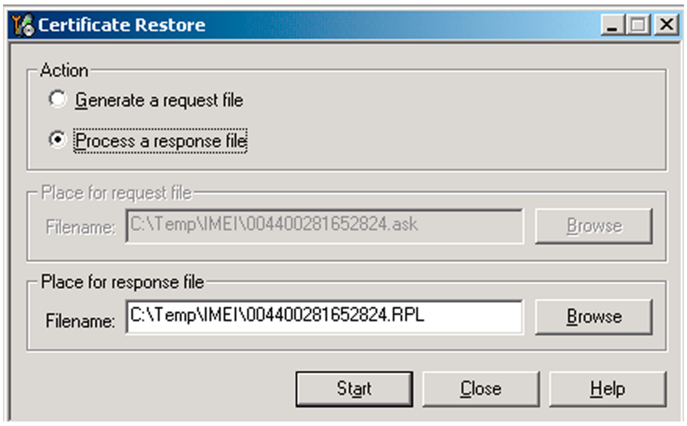
File name: 004400281652824.RPL

Files of type: Rpl files (*.rpl)

☐ Open as read-only

The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.


Certificate Restore
Action
Place for request file
Place for response file
Browse
Browse
Start
Close
Help

○ Generate a request file
● Process a response file

Filename: C:\Temp\IMEI\004400281652824.ask

Filename: C:\Temp\IMEI\004400281652824.RPL

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File**→ **Scan Product.**
4. Choose **Tuning**→**Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

    Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.

8. Click **Calibrate**.

    The calibration of the selected item(s) is carried out automatically.

    The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 3 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

4 — RF Troubleshooting and Manual Tuning Guide

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  Introduction to RX troubleshooting 4–7
  General instructions for RX troubleshooting 4–7
  Receiver (RX) troubleshooting 4–9
  GSM Rx chain activation for manual measurements / GSM RSSI measurement.... 4–11
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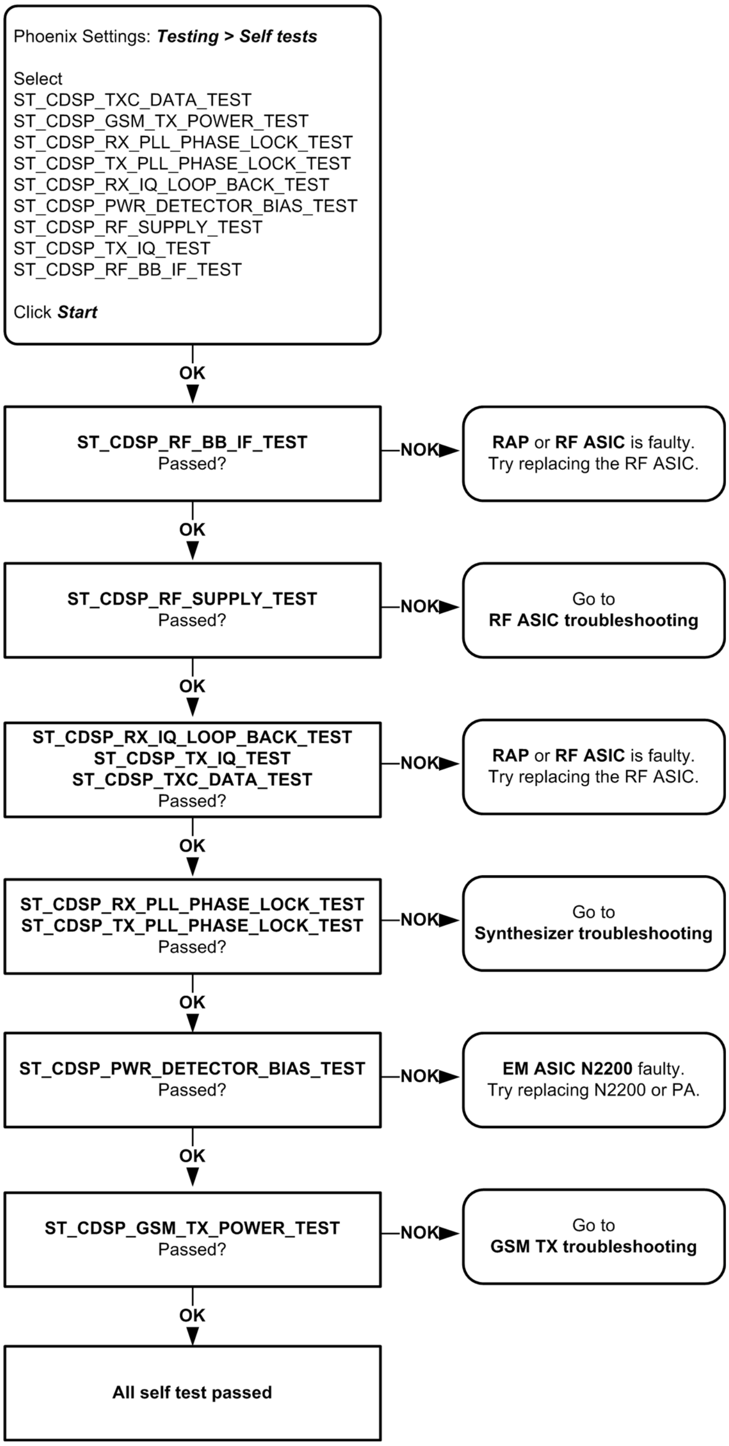
RF self tests in Phoenix

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

Troubleshooting flow


Phoenix Settings: Testing > Self tests
Select
ST_CDSP_TXC_DATA_TEST
ST_CDSP_GSM_TX_POWER_TEST
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_PWR_DETECTOR_BIAS_TEST
ST_CDSP_RF_SUPPLY_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_RF_BB_IF_TEST
Click Start
OK
ST_CDSP_RF_BB_IF_TEST Passed?
NOK
RAP or RF ASIC is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RF_SUPPLY_TEST Passed?
NOK
Go to RF ASIC troubleshooting
OK
ST_CDSP_RX_IQ_LOOP_BACK_TEST ST_CDSP_TX_IQ_TEST ST_CDSP_TXC_DATA_TEST Passed?
NOK
RAP or RF ASIC is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RX_PLL_PHASE_LOCK_TEST ST_CDSP_TX_PLL_PHASE_LOCK_TEST Passed?
NOK
Go to Synthesizer troubleshooting
OK
ST_CDSP_PWR_DETECTOR_BIAS_TEST Passed?
NOK
EM ASIC N2200 faulty. Try replacing N2200 or PA.
OK
ST_CDSP_GSM_TX_POWER_TEST Passed?
NOK
Go to GSM TX troubleshooting
OK
All self test passed

Introduction to RF troubleshooting

On the following pages you will find a step-by-step troubleshooting procedure and reference measurements at the relevant signal points. For functional descriptions, please refer to the System module section.

Notes on reference measurements

All measurements must be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

> **Important:** All measurements with an RF coupler must be performed in an RF shielded environment, or where there are no transmissions on the same frequencies. This may disturb sensitive receiver measurements.

Repairing this phone - important

The RF section of the phone is built around one RF ASIC. Before changing the RF ASIC, please make sure that supply voltages and serial communication coming from baseband to RF are OK.

Please note that the grounding of the FEM module is directly below the FEM module. Therefore, it is difficult to check or change the module.

Most RF semiconductors are static discharge sensitive! ESD protection must be taken care of during repair (ground straps and ESD soldering irons). The RF ASIC and FEM are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

Capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully.

Keep in mind that all measured voltages or RF levels depicted in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig, then “GND” pads should be used for the probe ground.

Supported bands

The following part of the service manual contains a description of all four GSM bands. It covers both variants, RM-249 and RM-250. Both variants support three GSM bands as follows:

- **RM-249**: GSM900, GSM1800, GSM1900
- **RM-250**: GSM850, GSM1800, GSM1900

Make sure to investigate only the bands, which the phone is made for.

RF key components

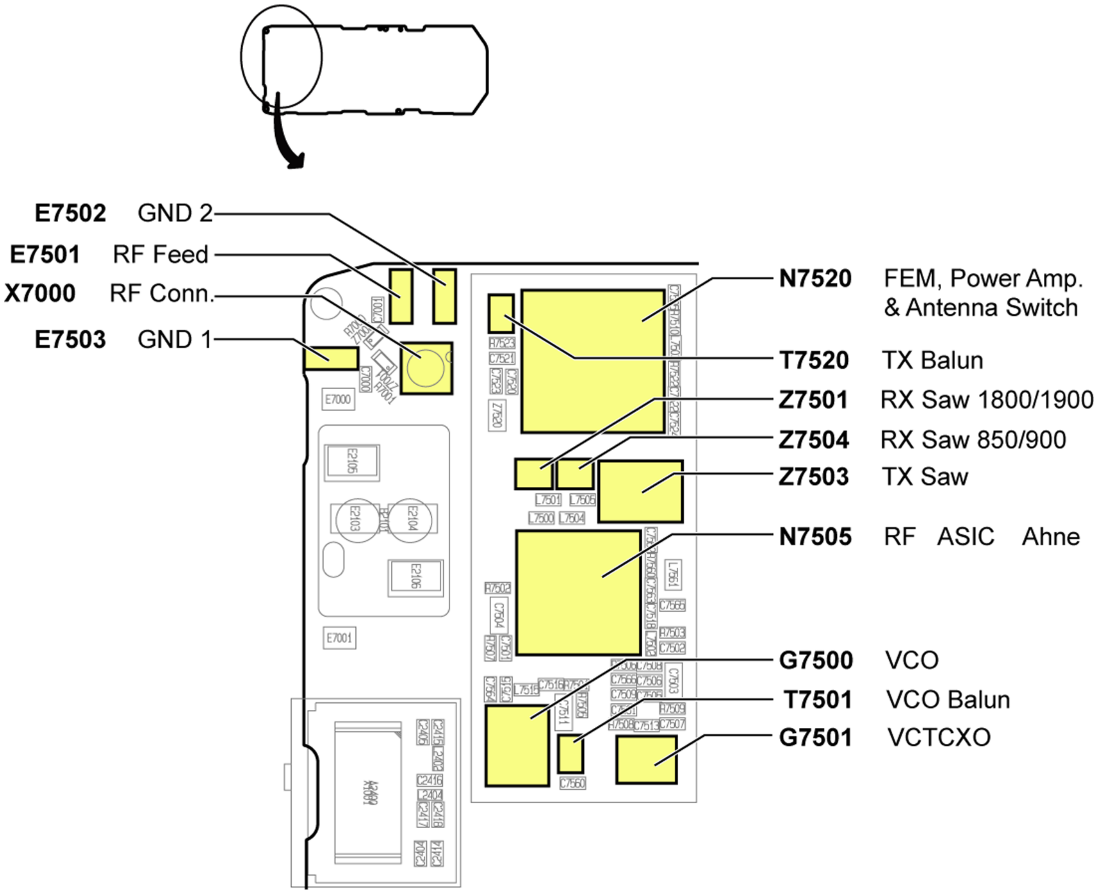

E7502 GND 2
E7501 RF Feed
X7000 RF Conn.
E7503 GND 1
N7520 FEM, Power Amp. & Antenna Switch
T7520 TX Balun
Z7501 RX Saw 1800/1900
Z7504 RX Saw 850/900
Z7503 TX Saw
N7505 RF ASIC Ahne
G7500 VCO
T7501 VCO Balun
G7501 VCTCXO

Figure 14 RF key components, bottom side main board

Receiver troubleshooting

Introduction to RX troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.

The main Rx troubleshooting measurement is RSSI measurement. This test measures the signal strength of the received signal. I and Q branches can be measured separately.

In GSM, the input signal can be either a real GSM signal or a CW signal that is 67.71 kHz up from the carrier frequency.

For service tool usage instructions, refer to section Service Tools and Service Concepts.

General instructions for RX troubleshooting

Steps

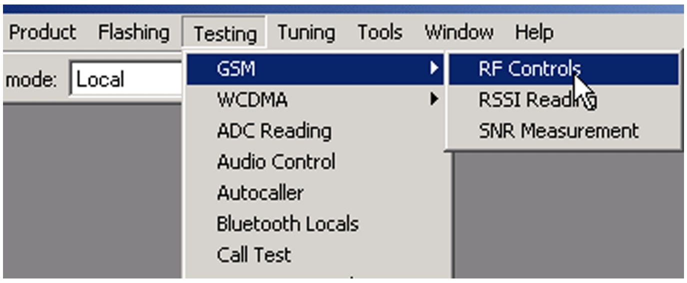
1. Connect a test jig to a computer with a DAU-9S cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.
2. Connect CU-4 with 12 V supply. The DC supply voltage is set to 3.7 V by default (in Phoenix).

3. Connect an RF cable between the RF connector of the module test jig (MJ-140) and measurement equipment or alternatively use a 50 Ω (at least 2 W) dummy load in the module test jig RF connector, otherwise the RF part may be damaged.

   Note: Make sure that all connections are made to the correct RF connector.

4. Set Rx on.
   - i Set the phone module to the test jig and start *Phoenix service software*.
   - ii Initialize connection to the phone. (With the FPS-10 prommer use FPS10_USB or FPS10_TCP drivers, depending on connection type. When using DAU-9S select FBUS).
   - iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone, eg. RM-249/250), or press **Ctrl + R** to scan product.
   - iv From the toolbar, set operating mode to “Local”.
5. EGSM850/900/1800/1900 troubleshooting
   - i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .

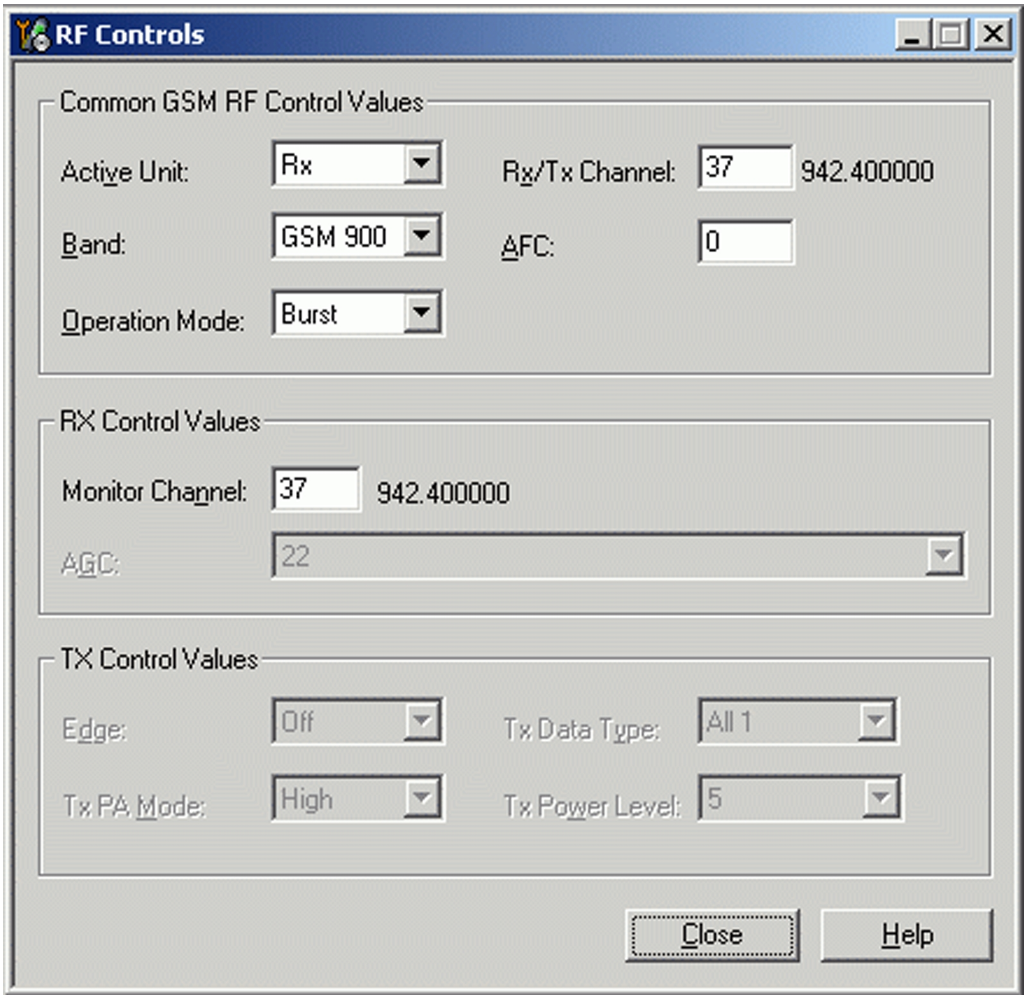

Product
Flashing
Testing
Tuning
Tools
Window
Help
mode:
Local
GSM
WCDMA
ADC Reading
Audio Control
Autocaller
Bluetooth Locals
Call Test
RF Controls
RSSI Reading
SNR Measurement

   - ii In the *RF Controls* window:
     - Select band.
     - Set Active unit to “Rx” (Default).
     - Set Operation mode to “Burst” (Default).
     - Set Rx/Tx channel (see table below).
     - Apply a frequency (see table below) to the RF-connector.

     Note: Remember to compensate for cable attenuation, specific for MJ-140. You will find the values in the Service tools section.

     Apply a signal to the RF-connector (remember to compensate for cable attenuation). See values in the table below.

Band	Channel (RX and TX)	Input frequency (MHz)	Offset (kHz)	Power level (dBm)
GSM850	190	881.66771	67.710	-90
GSM900	37	942.46771	67.710	-90
GSM1800	700	1842.86771	67.710	-90
GSM1900	661	1960.06771	67.710	-90



RF Controls

Common GSM RF Control Values

Active Unit: Rx

Rx/Tx Channel: 37 942.400000

Band: GSM 900

AFC: 0

Operation Mode: Burst

RX Control Values

Monitor Channel: 37 942.400000

AGC: 22

TX Control Values

Edge: Off

Tx Data Type: All 1

Tx PA Mode: High

Tx Power Level: 5

Figure 15 RF Controls window

Receiver (RX) troubleshooting

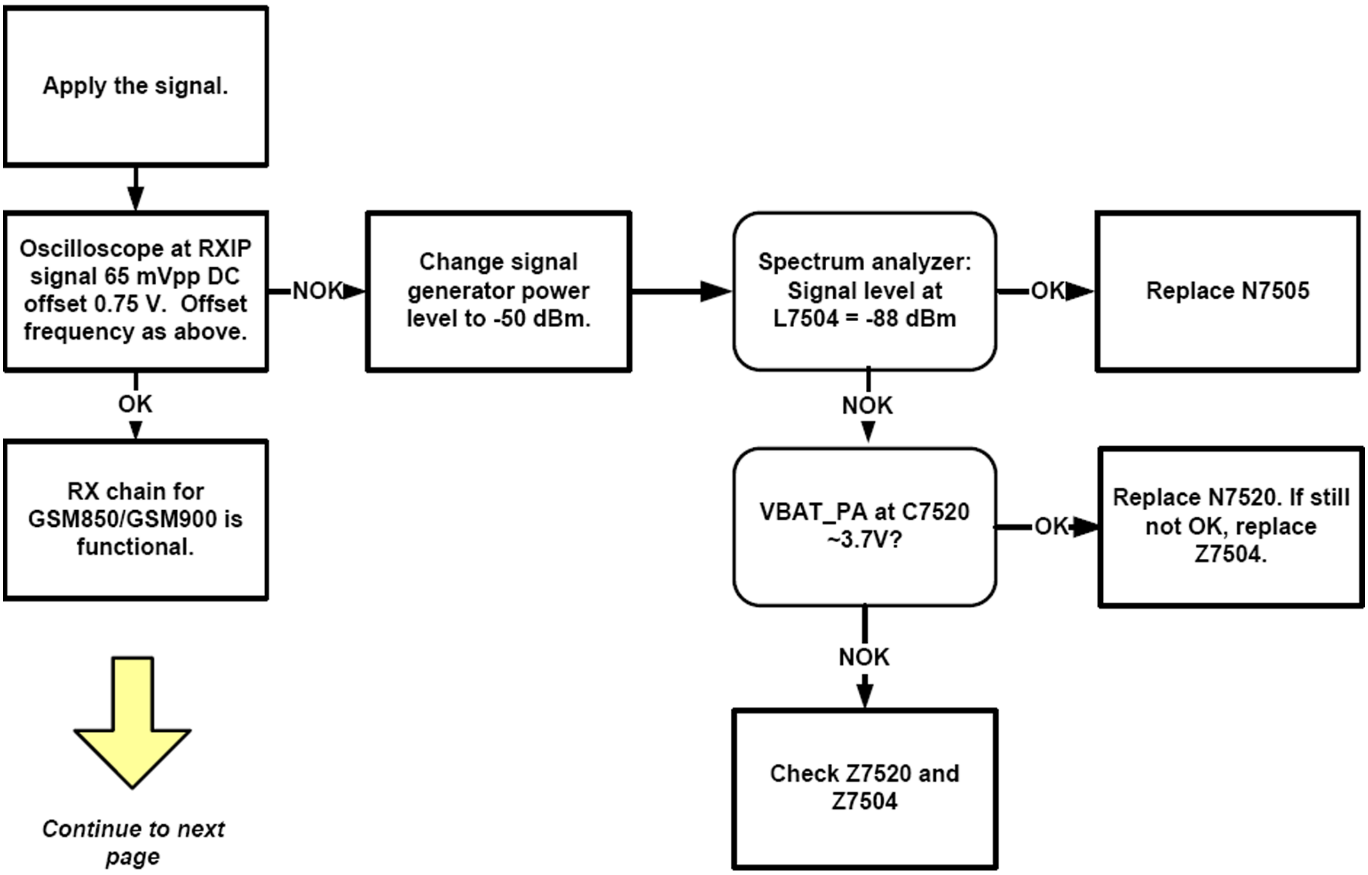
Context

Troubleshoot one band at a time. Start with the lowest band, and end with GSM1900.

Receiver troubleshooting

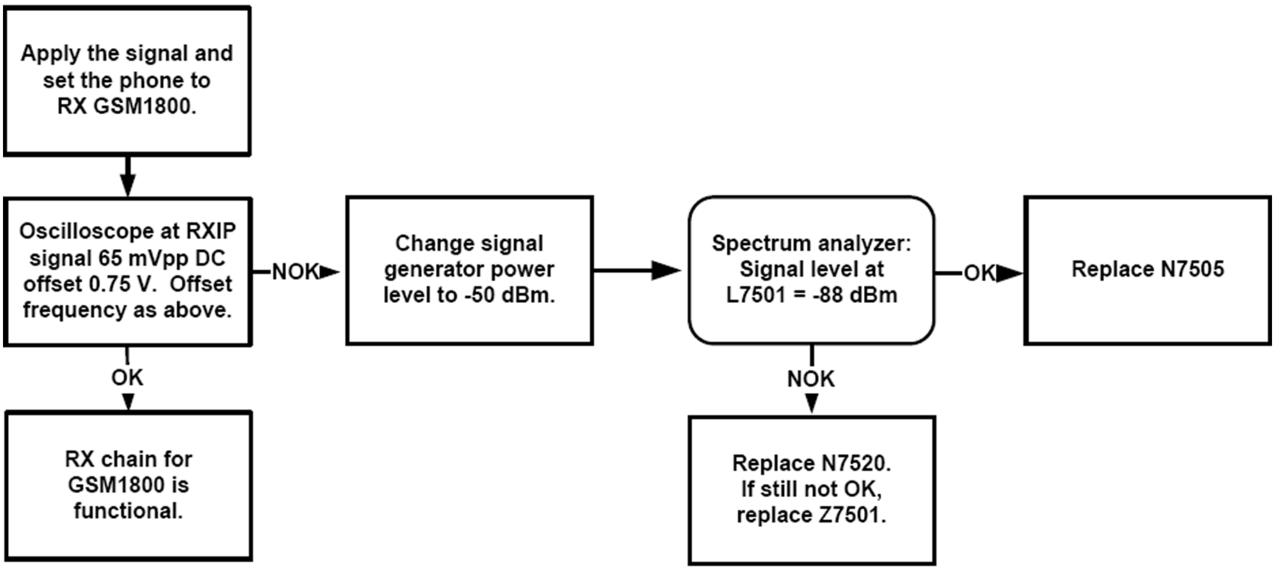
Apply a signal according to the table in General instructions for RX troubleshooting (page 4–7)

GSM850 or GSM900

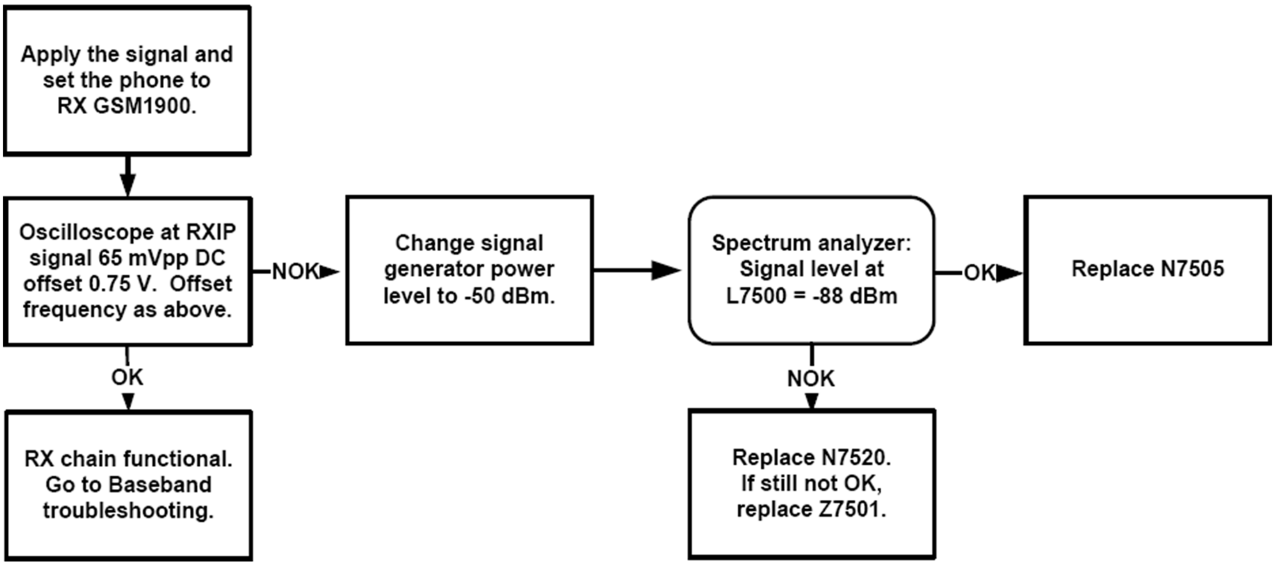

Apply the signal.
Oscilloscope at RXIP signal 65 mVpp DC offset 0.75 V. Offset frequency as above.
NOK
Change signal generator power level to -50 dBm.
Spectrum analyzer: Signal level at L7504 = -88 dBm
OK
Replace N7505
OK
RX chain for GSM850/GSM900 is functional.
NOK
VBAT_PA at C7520 ~3.7V?
OK
Replace N7520. If still not OK, replace Z7504.
NOK
Check Z7520 and Z7504
Continue to next page

Continued from previous page

GSM1800


Apply the signal and set the phone to RX GSM1800.
Oscilloscope at RXIP signal 65 mVpp DC offset 0.75 V. Offset frequency as above.
NOK
Change signal generator power level to -50 dBm.
Spectrum analyzer: Signal level at L7501 = -88 dBm
OK
Replace N7505
NOK
Replace N7520. If still not OK, replace Z7501.
OK
RX chain for GSM1800 is functional.

GSM1900


Apply the signal and set the phone to RX GSM1900.
Oscilloscope at RXIP signal 65 mVpp DC offset 0.75 V. Offset frequency as above.
NOK
Change signal generator power level to -50 dBm.
Spectrum analyzer: Signal level at L7500 = -88 dBm
OK
Replace N7505
NOK
Replace N7520. If still not OK, replace Z7501.
OK
RX chain functional. Go to Baseband troubleshooting.

GSM Rx chain activation for manual measurements / GSM RSSI measurement

Context

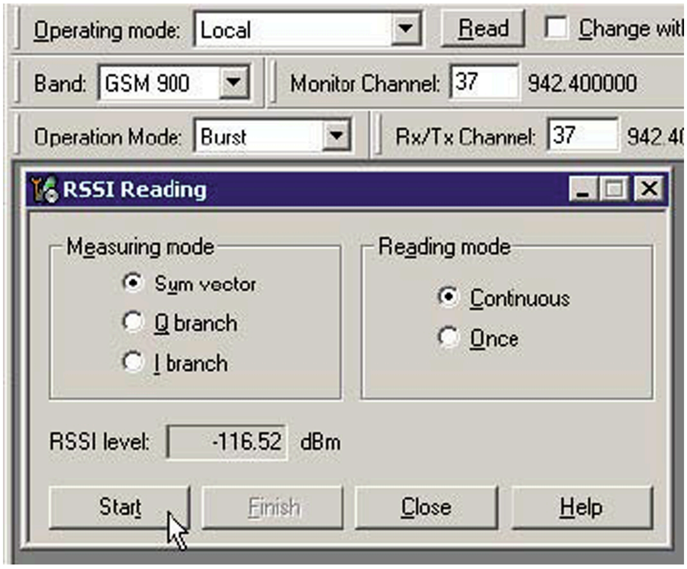
RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either a real GSM signal or a CW (Continuous Wave) signal that is 67.71 kHz above the carrier frequency.

Steps

1. Start *Phoenix* service software.
2. Choose **Testing→GSM→RSSI Reading** .
3. Set the RF signal generator for a channel frequency +67.71 kHz in CW mode with a –80 dBm signal level.

   Alternatively set the cellular tester downlink channel to the appropriate channel. Make sure that the tester is set to continuous mode, not to burst mode.
4. In the *RSSI Reading* window, select the appropriate band and channel.



Operating mode: Local

Band: GSM 900

Monitor Channel: 37 942.400000

Operation Mode: Burst

Rx/Tx Channel: 37 942.4

RSSI Reading

Measuring mode
● Sum vector
○ Q branch
○ I branch

Reading mode
● Continuous
○ Once

RSSI level: -116.52 dBm

Figure 16 *RSSI Reading* window

5. To start the measurement, activate GSM Rx chain, click **Start**.

Results

RSSI reading values of the selected band and channel are displayed. The RSSI level must be the same value as that which is set at the signal generator (-80 dBm).

Transmitter troubleshooting

General instructions for TX troubleshooting

Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use!
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls".

- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a fix! Phones are tuned correctly in production.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software.

> **Caution:** Never activate the GSM transmitter without a proper antenna load. There should be always 50 Ω load connected to the RF connector (antenna, RF-measurement equipment or at least 2 W dummy load), otherwise the GSM Power amplifier may be damaged.

Steps

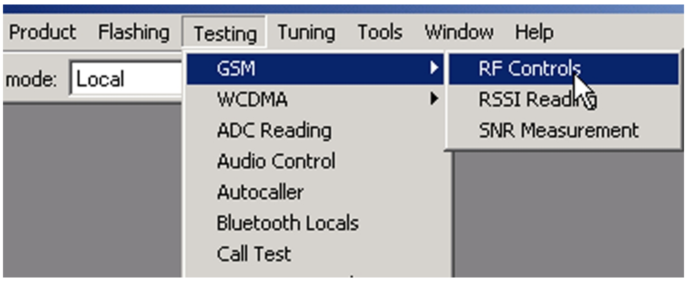
1. Connect a test jig to a computer with a DAU-9S cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

   Make sure that you have a PKD-1 dongle connected to the computer's parallel port.
2. Connect CU-4 with 12 V supply. The DC supply voltage is set to 3.7 V by default (in Phoenix).
3. Connect an RF cable between the RF connector of the module test jig (MJ-140) and measurement equipment or alternatively use a 50 Ω (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM may be damaged.

   > **Note:** There are two antenna connectors in the module jig:
   > - one for GSM
   > - one for Bluetooth
   >
   > Make sure that all connections are made to the correct RF connector.

   Normally a spectrum analyser is used as measurement equipment.

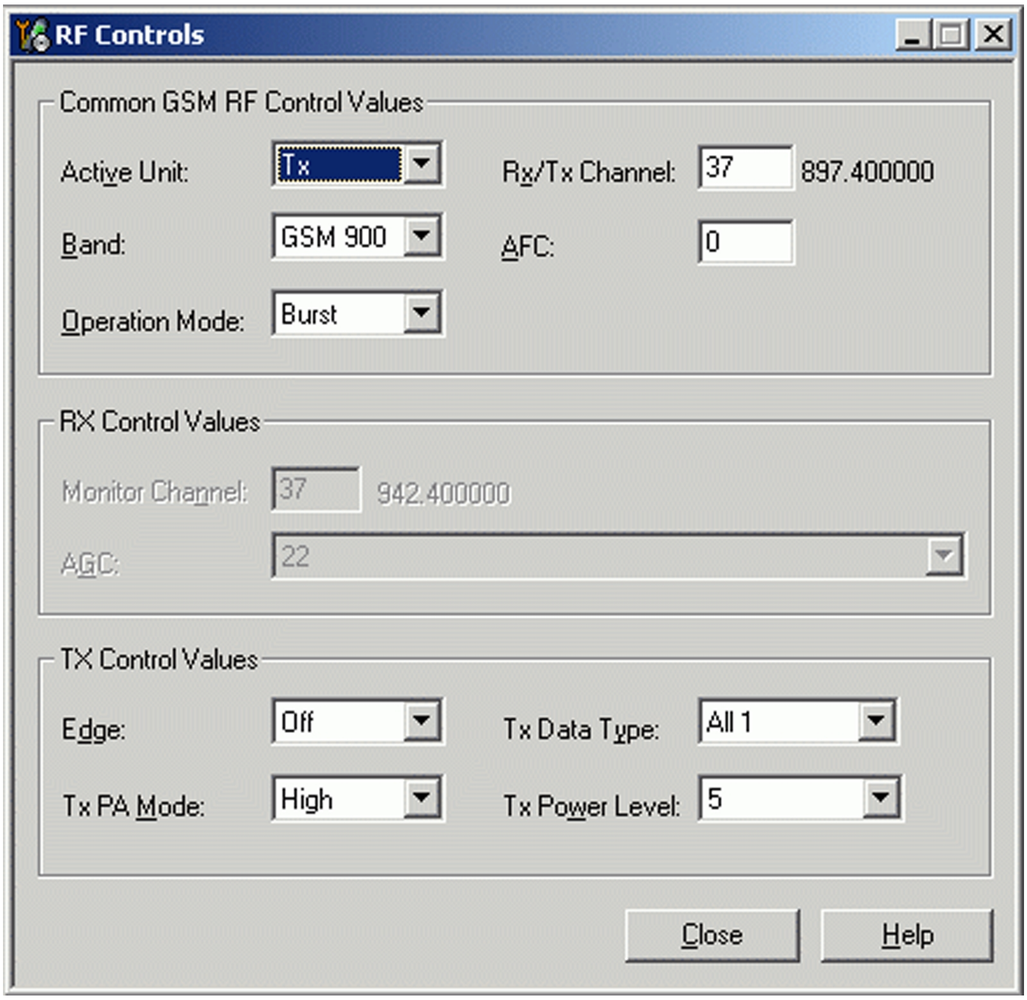
   > **Note:** The maximum input power of a spectrum analyser is +30 dBm.
   >
   > To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.
4. Set Tx on.
   - i Set the phone module to the test jig and start *Phoenix service software*.
   - ii Initialize connection to the phone. (With the FPS-10 prommer use FPS10_USB or FPS10_TCP drivers, depending on connection type. When using DAU-9S select FBUS driver).
   - iii From the File menu, choose product: **File -> Choose Product -> xx-x*** (* = type designator of the phone, e.g. RM-249/250), or press**Ctrl + R** to scan product.
   - iv From the toolbar, set operating mode to “Local”.
5. GSM850/900/1800/1900 troubleshooting
   - i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls** .



   - ii In the *RF Controls* window:
     - Select band "GSM850", “GSM900” or “GSM1800” or “GSM1900”.
     - Set Active unit to “Tx” (Default = “Rx”).

- Set Operation mode to “Burst” (Default).
- Set Tx data type to “All1” (Default).
- Set Rx/Tx channel (see table below)
- Set Edge to “Off” (Default).
- Set Tx PA mode to “High” (Default).
- Set power level (see table below)

Band	Channel (RX and TX)	TX power level
GSM850	190	5
GSM900	37	5
GSM1800	700	0
GSM1900	661	0


RF Controls

Common GSM RF Control Values
Active Unit: Tx
Rx/Tx Channel: 37 897.400000
Band: GSM 900
AFC: 0
Operation Mode: Burst

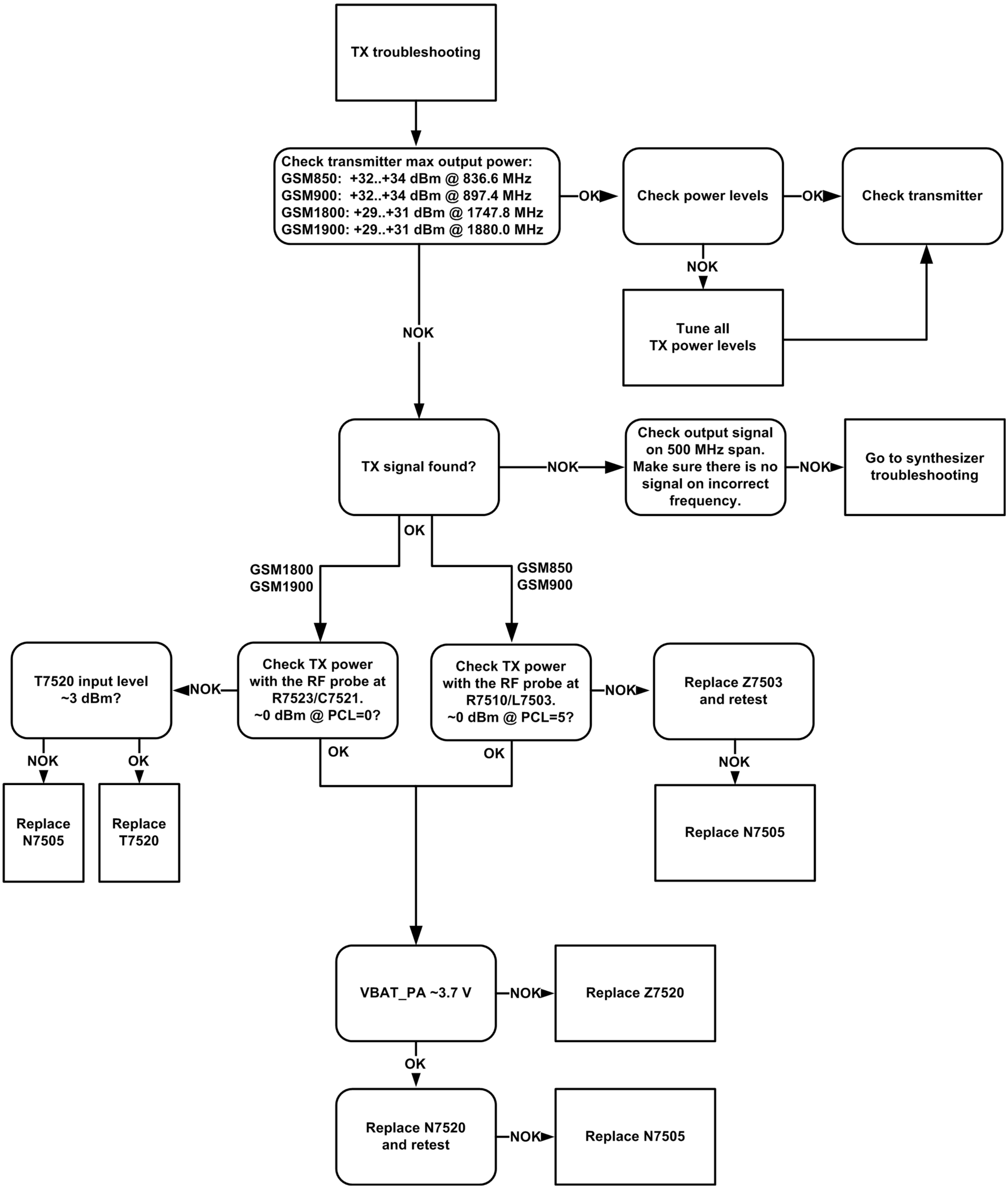
RX Control Values
Monitor Channel: 37 942.400000
AGC: 22

TX Control Values
Edge: Off
Tx Data Type: All 1
Tx PA Mode: High
Tx Power Level: 5

Figure 17 RF Controls window

Transceiver (TX) troubleshooting

Troubleshooting flow


TX troubleshooting
Check transmitter max output power:
GSM850: +32..+34 dBm @ 836.6 MHz
GSM900: +32..+34 dBm @ 897.4 MHz
GSM1800: +29..+31 dBm @ 1747.8 MHz
GSM1900: +29..+31 dBm @ 1880.0 MHz
OK
Check power levels
OK
Check transmitter
NOK
Tune all TX power levels
NOK
TX signal found?
NOK
Check output signal on 500 MHz span. Make sure there is no signal on incorrect frequency.
NOK
Go to synthesizer troubleshooting
OK
GSM1800
GSM1900
GSM850
GSM900
T7520 input level ~3 dBm?
NOK
Check TX power with the RF probe at R7523/C7521. ~0 dBm @ PCL=0?
Check TX power with the RF probe at R7510/L7503. ~0 dBm @ PCL=5?
NOK
Replace Z7503 and retest
NOK
OK
NOK
OK
OK
NOK
Replace N7505
Replace T7520
Replace N7505
VBAT_PA ~3.7 V
NOK
Replace Z7520
OK
Replace N7520 and retest
NOK
Replace N7505

Checking antenna functionality

GSM antenna

In the GSM antenna, there is one feed and two GND contacts.

Between GND1 and Feed, a DC short-circuit can be measured.

GND2 has no DC connection to the other contacts.

The antenna is functioning normally, if the contact pads hit the antenna C-clips on the PWB and the antenna is visually intact.

BT antenna

The BT antenna is (as the GSM antenna) placed on the flex foil on the antenna module. It has one feed and one short contact. The antenna is functioning normally, if the contact pads hit the antenna C-clips on the PWB and the antenna is visually intact.

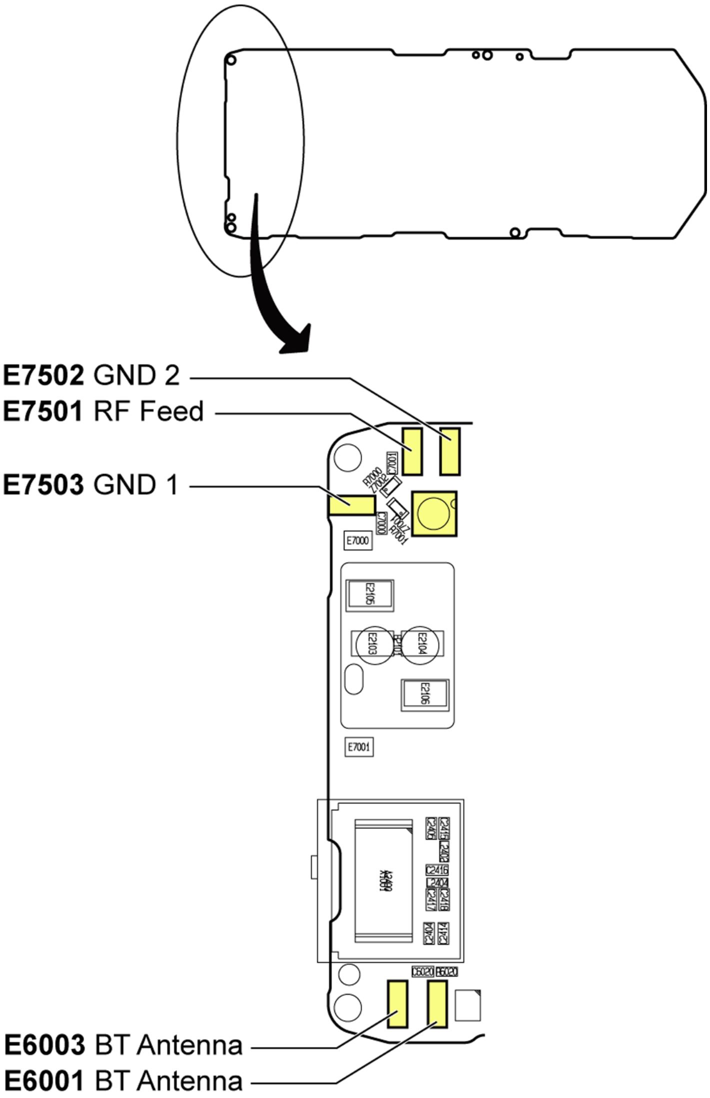


Figure 18 Location of the GSM and BT antenna C-clips on the PWB

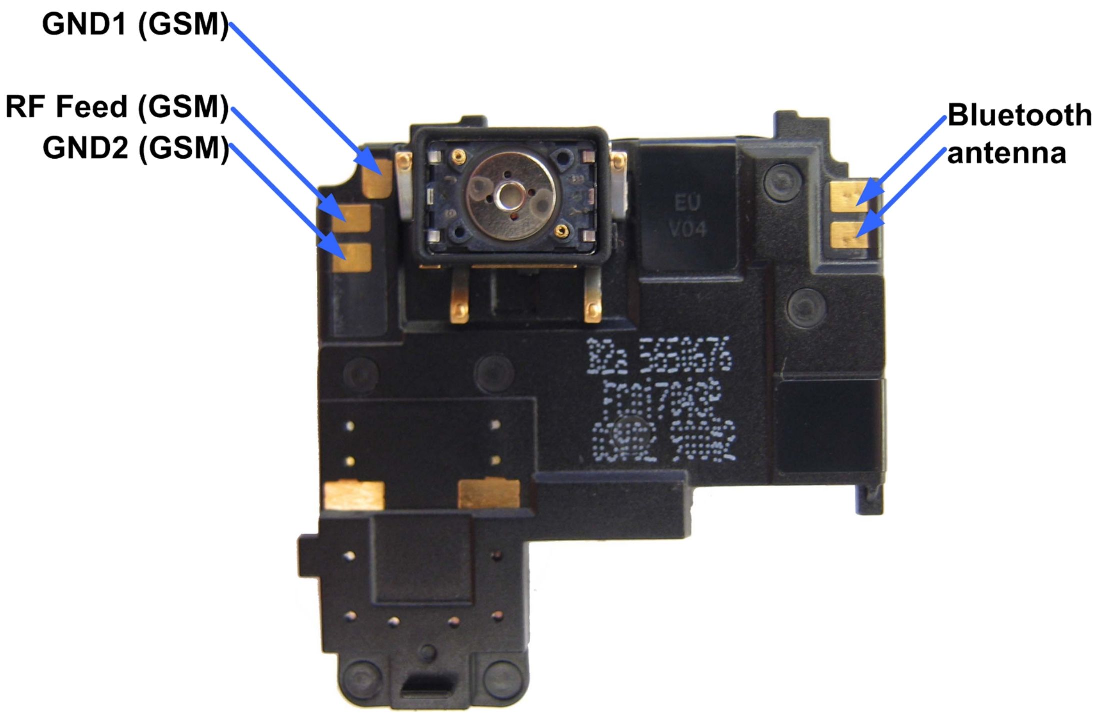

GND1 (GSM)
RF Feed (GSM)
GND2 (GSM)
Bluetooth antenna

Figure 19 GSM and BT antenna contact pads on the antenna module

Antenna C-clips

When checking the antenna functionality, you can also check that the antenna C-clips are intact (that is, there are no cracks/bends in them).

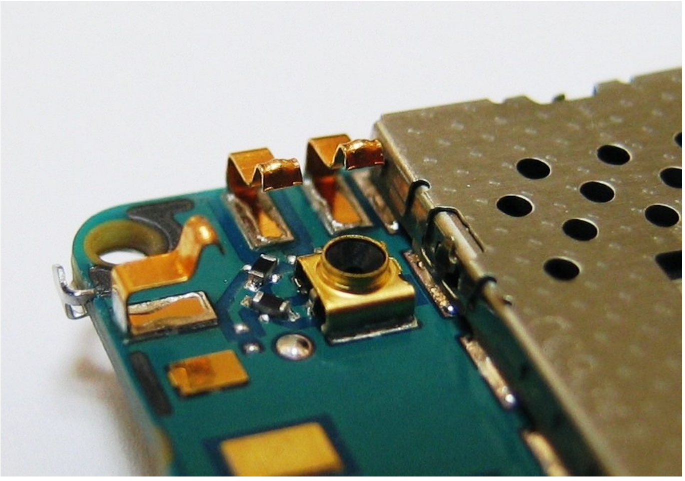
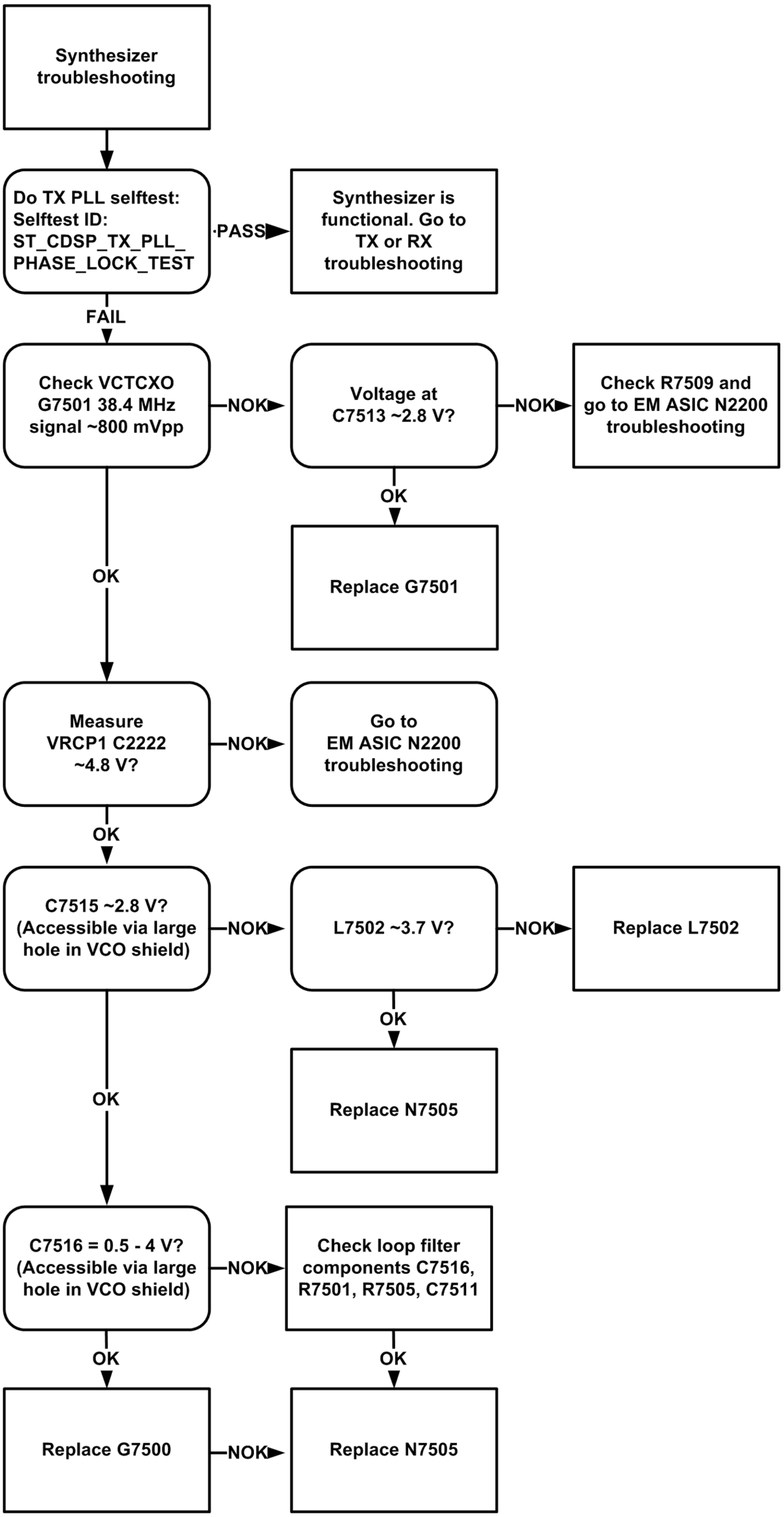


Figure 20 Antenna C-clips on the PWB

Synthesizer troubleshooting

Synthesizer troubleshooting


Synthesizer troubleshooting
Do TX PLL selftest: Selftest ID: ST_CDSP_TX_PLL_ PHASE_LOCK_TEST
PASS
Synthesizer is functional. Go to TX or RX troubleshooting
FAIL
Check VCTCXO G7501 38.4 MHz signal ~800 mVpp
NOK
Voltage at C7513 ~2.8 V?
NOK
Check R7509 and go to EM ASIC N2200 troubleshooting
OK
Replace G7501
OK
Measure VRCP1 C2222 ~4.8 V?
NOK
Go to EM ASIC N2200 troubleshooting
OK
C7515 ~2.8 V? (Accessible via large hole in VCO shield)
NOK
L7502 ~3.7 V?
NOK
Replace L7502
OK
Replace N7505
OK
C7516 = 0.5 - 4 V? (Accessible via large hole in VCO shield)
NOK
Check loop filter components C7516, R7501, R7505, C7511
OK
OK
Replace G7500
NOK
Replace N7505

RF tunings

Introduction to RF tunings

Important: Only perform RF tunings if:

- one or more of the RF components have been replaced
- flash memory chip is replaced or corrupted.

RF calibration is always performed with the help of a product-specific module jig (MJ-140), never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF part.

Important: After RF component replacements, **always** use autotuning. Manual tunings are only required in rare cases.

Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup.

For RF attenuations of the module jig, please refer to the Service tools section.

Auto tuning for BB5.0

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRF-1 (RF cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

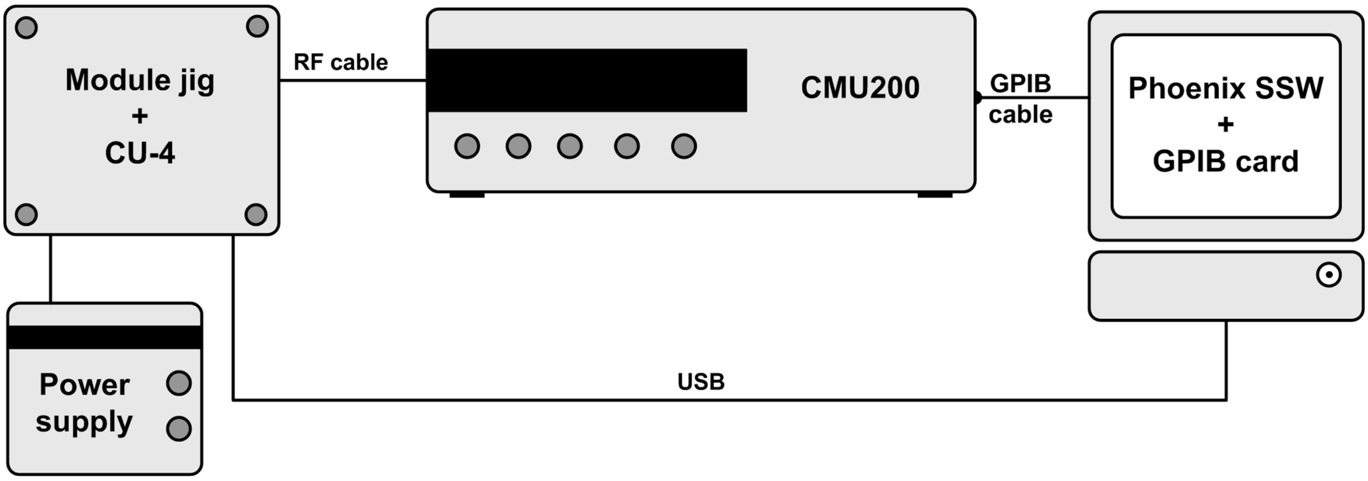


Figure 21 Auto tuning concept with CMU200

Phoenix preparations

Install the phone specific data package, for example *RM-249/250_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings..

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.

2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.

3 Start autotuning, clicking the *Tune* button.

System mode independent manual tunings

RF channel filter calibration

Context

Rf channel filter calibration tunes the internal low pass filters of the RF ASIC, that limit the bandwidth of BB IQ signals.

Table 4 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
RX mixer	0	13	31
Rx filter	0	16	31

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning→Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

Results

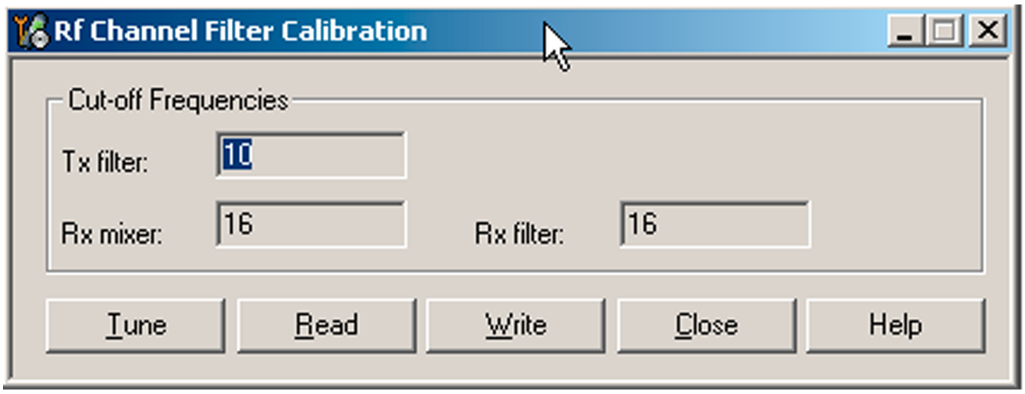

Rf Channel Filter Calibration
Cut-off Frequencies
Tx filter: 10
Rx mixer: 16
Rx filter: 16

Figure 22 Rf channel filter calibration typical values

PA (power amplifier) detection

Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning**→**PA Detection** .
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

GSM receiver tunings

Rx calibration (GSM)

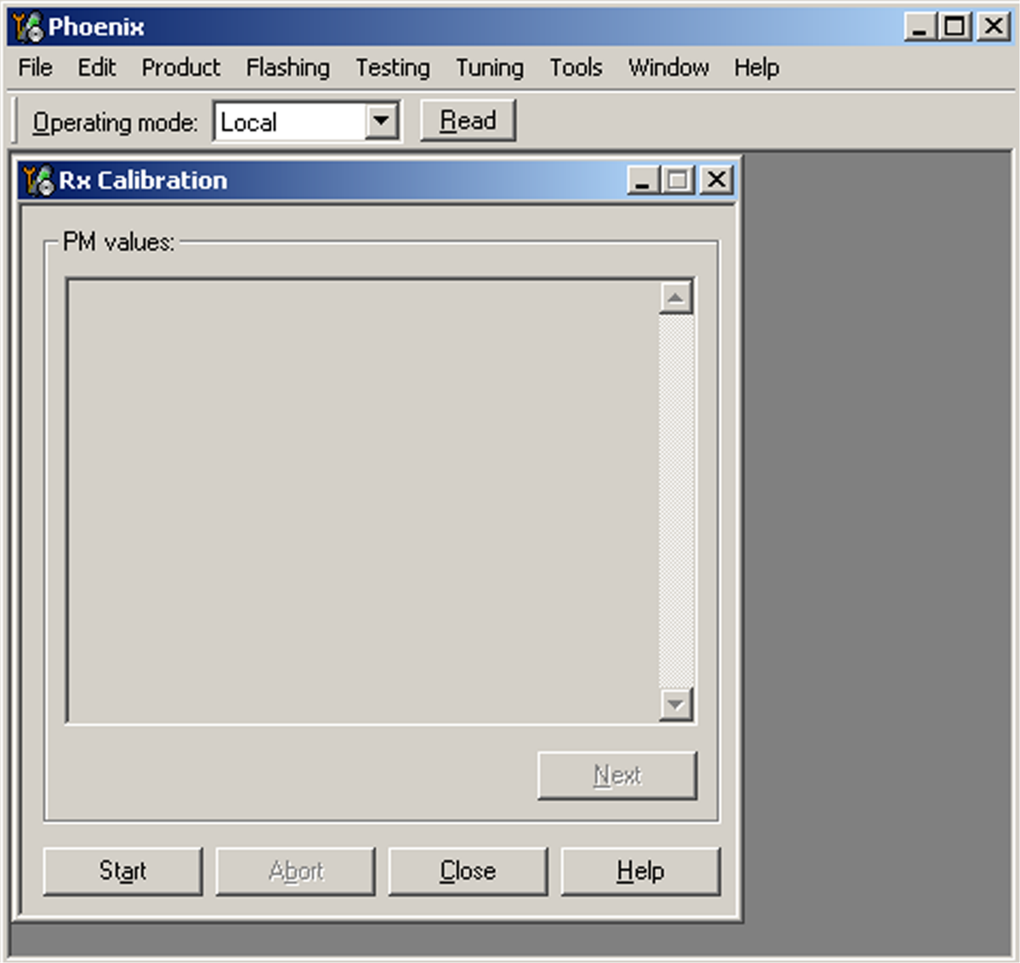
Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

Steps

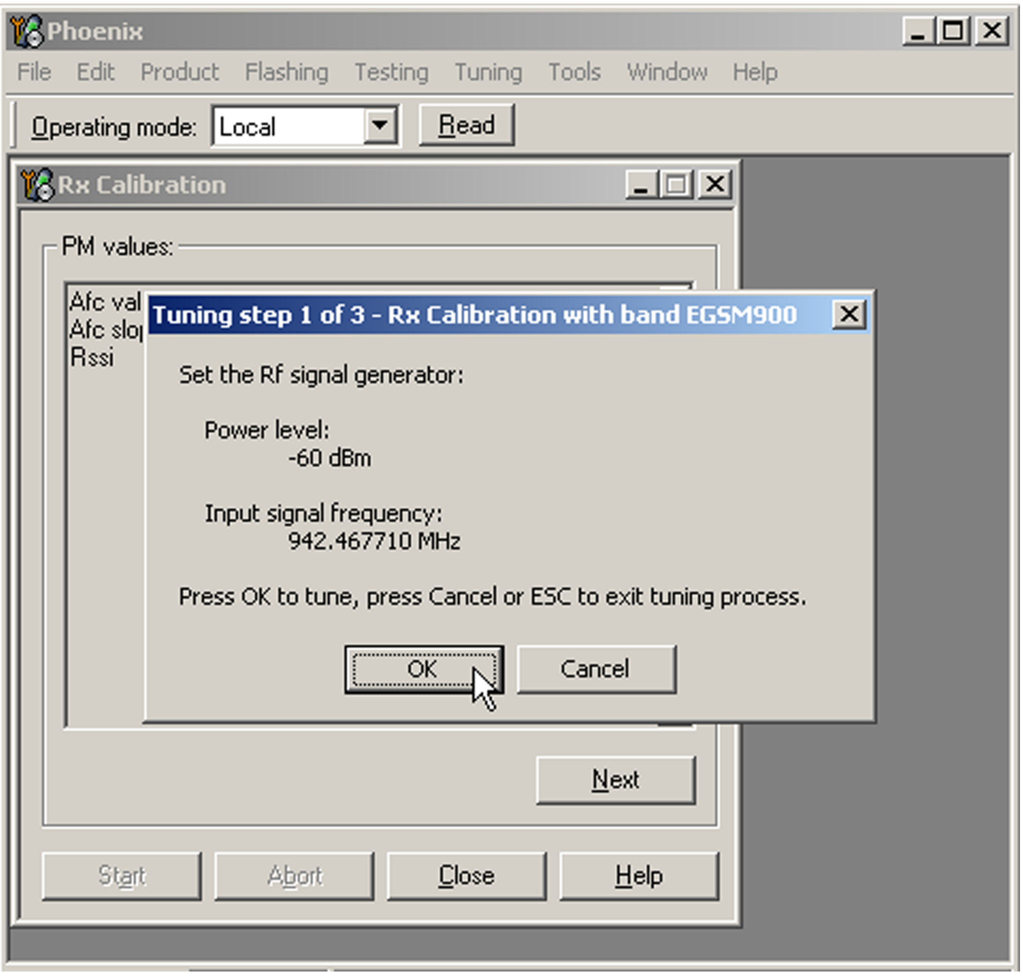
1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning**→**GSM**→**Rx Calibration** .

5. Click **Start**.


Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Calibration
PM values:
Next
Start
Abort
Close
Help

6. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** (step 1-3) pop-up window.

   Important: The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.



Phoenix
File Edit Product Flashing Testing Tuning Tools Window Help
Operating mode: Local
Read
Rx Calibration
PM values:
Afc val
Afc slo
Rssi
Tuning step 1 of 3 - Rx Calibration with band EGSM900
OK
Cancel
Next
Start
Abort
Close
Help

Set the Rf signal generator:

Power level:
-60 dBm

Input signal frequency:
942.467710 MHz

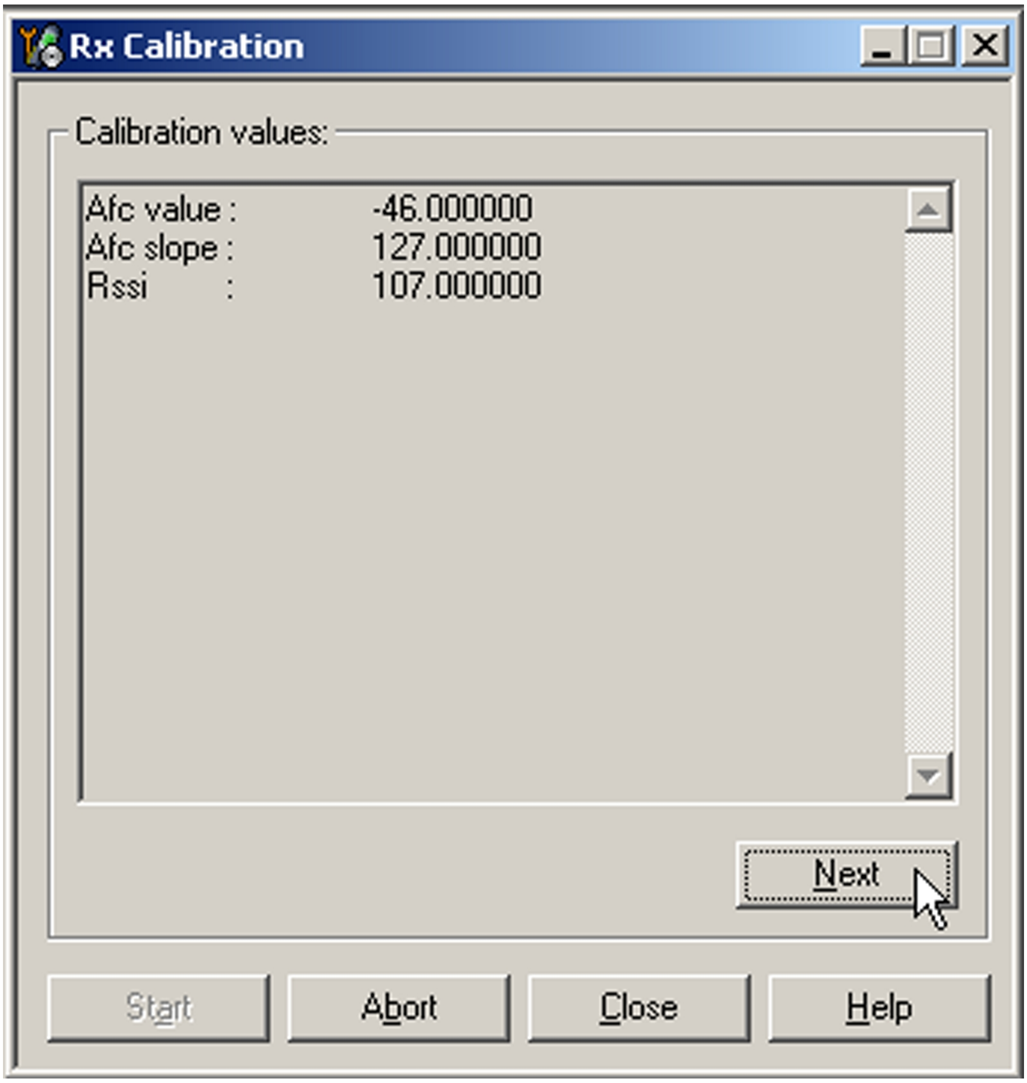
Press OK to tune, press Cancel or ESC to exit tuning process.

7. To perform the tuning, click **OK**.
8. Check that the tuning values are within the limits specified in the following table:

Table 5 RF tuning limits in Rx calibration

	Min	Typ	Max	Unit
GSM850				
AFC Value (init)	-200	-80..40	200	-
AFC slope	0	108..121	200	-
RSSI (AGC-0)	106	107..110	114	dB
GSM900				
AFC Value (init)	-200	-105..62	200	-
AFC slope	0	122	200	-
RSSI (AGC-0)	106	107...110	114	dB
GSM1800				
RSSI (AGC-0)	105	105...109	114	dB
GSM1900				
RSSI (AGC-0)	105	105...109	114	dB

9. Click **Next** to continue with GSM1800 Rx tuning.



Calibration values:

Afc value : -46.000000
Afc slope : 127.000000
Rssi : 107.000000

Next actions

Repeat steps 6 to 9 for GSM1800 and GSM1900

Rx band filter response compensation (GSM)

Prerequisites

Rx calibration must be performed before the Rx band filter response compensation.

Context

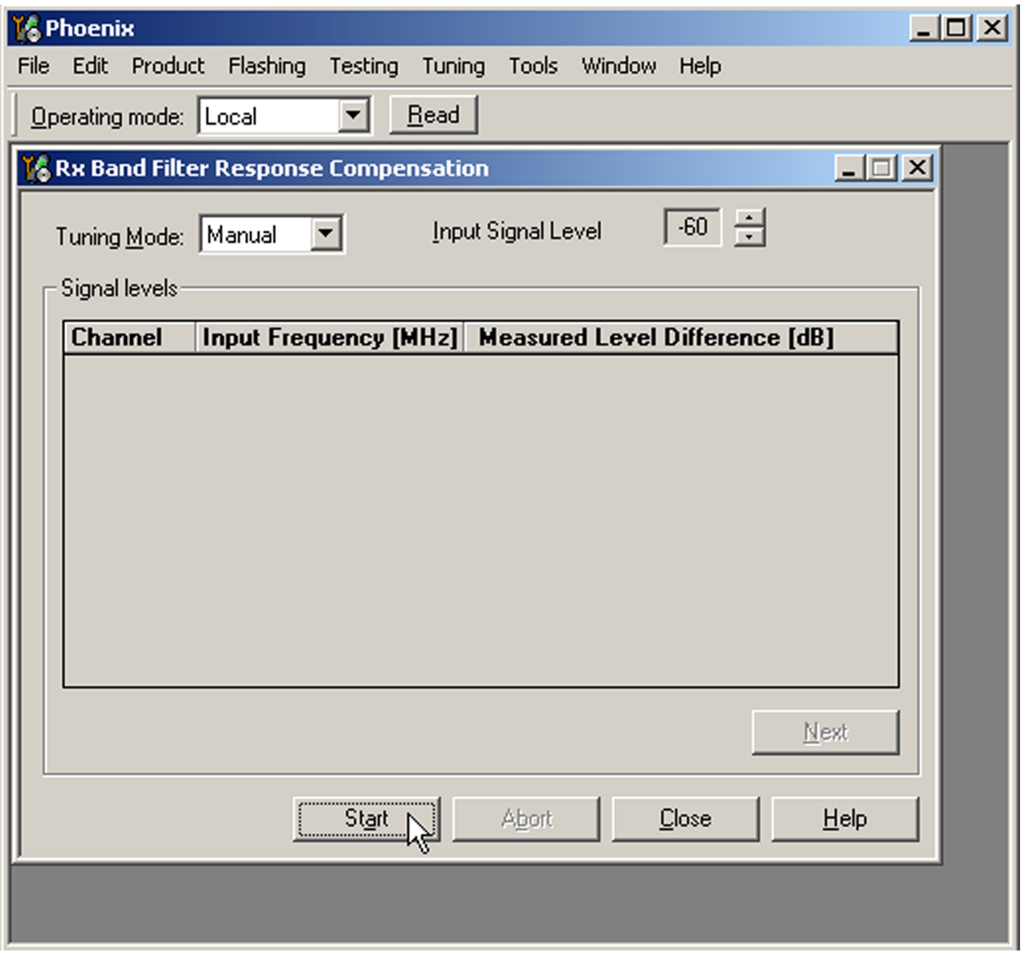
On each GSM Rx band, there is a band filter in front of the RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement, and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.

4. Select **GSM850** or **GSM900** band.
5. Choose **Tuning→GSM→Rx Band Filter Response Compensation** .
6. Select **Tuning mode: manual**
7. Click **Start**.


Phoenix
File
Edit
Product
Flashing
Testing
Tuning
Tools
Window
Help
Read
Rx Band Filter Response Compensation
Signal levels
Next
Start
Abort
Close
Help

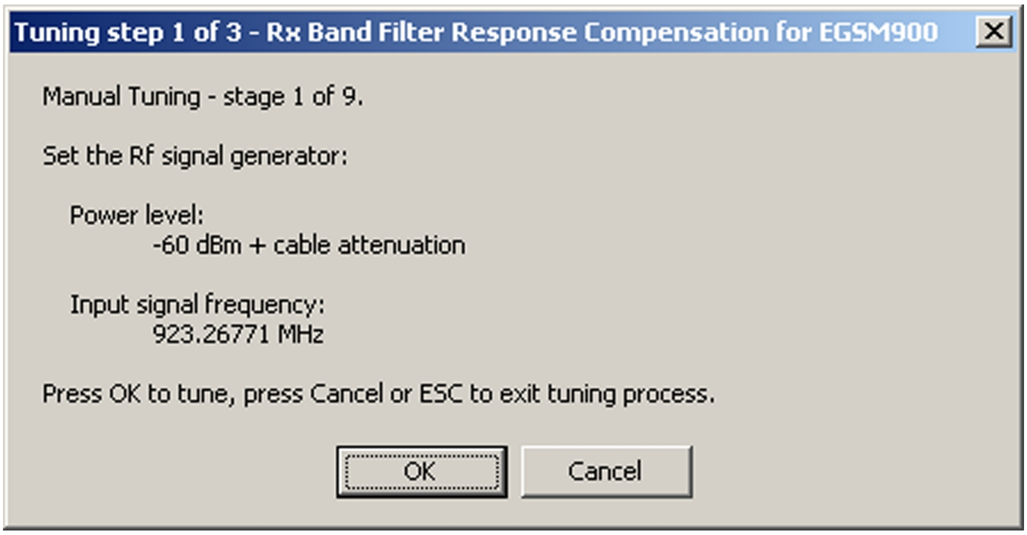
Operating mode: Local

Tuning Mode: Manual

Input Signal Level -60

Channel	Input Frequency [MHz]	Measured Level Difference [dB]

8. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the *Rx Band Filter Response Compensation for EGSM850/EGSM900* pop-up window, step 1-3.



Tuning step 1 of 3 - Rx Band Filter Response Compensation for EGSM900

Manual Tuning - stage 1 of 9.

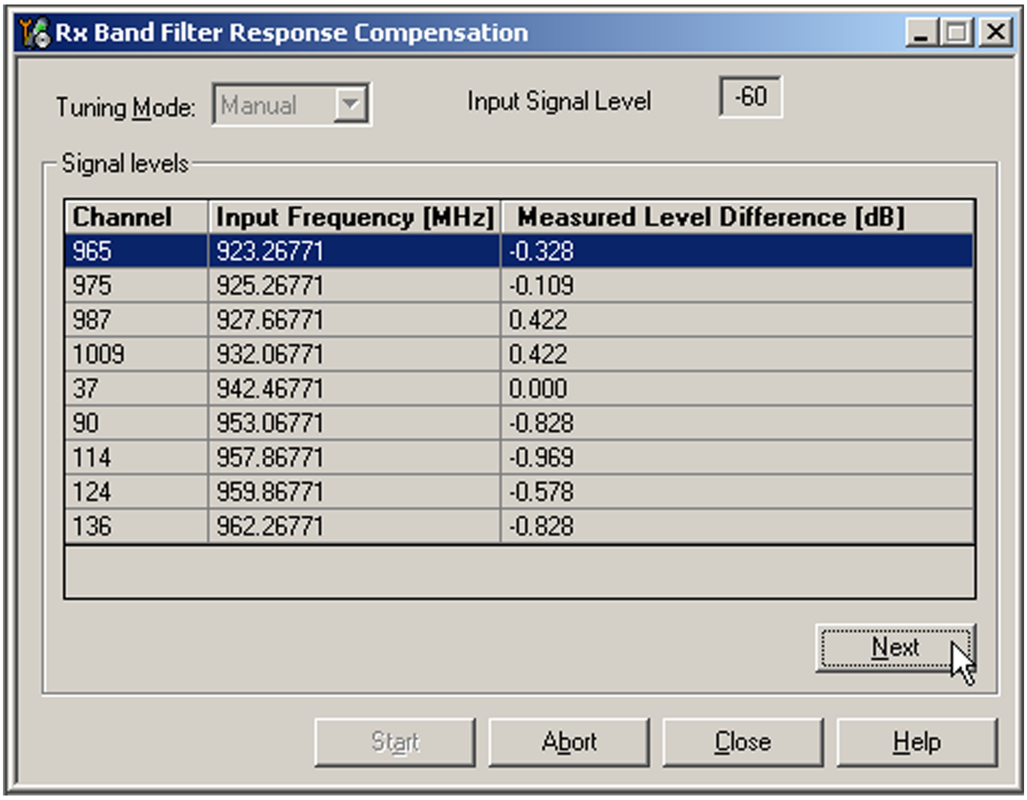
Set the Rf signal generator:

Power level:
-60 dBm + cable attenuation

Input signal frequency:
923.26771 MHz

Press OK to tune, press Cancel or ESC to exit tuning process.

9. To perform tuning, click **OK**.
10. Go through all 9 frequencies. The following table will be shown:



Rx Band Filter Response Compensation

Tuning Mode: Manual

Input Signal Level: -60

Signal levels

Channel	Input Frequency [MHz]	Measured Level Difference [dB]
965	923.26771	-0.328
975	925.26771	-0.109
987	927.66771	0.422
1009	932.06771	0.422
37	942.46771	0.000
90	953.06771	-0.828
114	957.86771	-0.969
124	959.86771	-0.578
136	962.26771	-0.828

11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
GSM850				
Ch. 118/867.26771 MHz	-6	-1	2	dB
Ch. 128/869.26771 MHz	-3	0	2	dB
Ch. 140/871.66771 MHz	-3	0	2	dB
Ch. 172/878.06771 MHz	-2	0	2	dB
Ch. 190/881.66771 MHz	-2	0	2	dB
Ch. 217 / 887.06771 MHz	-2	0	2	dB
Ch. 241/891.86771 MHz	-3	0	2	dB
Ch. 251/893.86771 MHz	-3	0	2	dB
Ch. 261/895.86771 MHz	-6	-1	-2	dB
GSM900				
Ch. 965 / 923.26771 MHz	-6	-1	2	dB
Ch. 975 / 925.26771 MHz	-3	0	2	dB
Ch. 987 / 927.66771 MHz	-3	0	2	dB
Ch. 1009 / 932.06771 MHz	-2	0	2	dB

	Min	Typ	Max	Unit
Ch. 37 / 942.46771 MHz	-2	0	2	dB
Ch. 90 / 953.06771 MHz	-2	0	2	dB
Ch. 114 / 957.86771 MHz	-3	0	2	dB
Ch. 124 / 959.86771 MHz	-3	0	2	dB
Ch. 136 / 962.26771 MHz	-6	-1	2	dB
GSM1800				
Ch. 497 / 1802.26771 MHz	-6	-1	3	dB
Ch. 512 / 1805.26771 MHz	-3	0	3	dB
Ch. 535 / 1809.86771 MHz	-3	0	3	dB
Ch. 606 / 1824.06771 MHz	-3	0	3	dB
Ch. 700 / 1842.86771 MHz	-3	0	3	dB
Ch. 791 / 1861.06771 MHz	-3	0	3	dB
Ch. 870 / 1876.86771 MHz	-3	0	3	dB
Ch. 885 / 1879.86771 MHz	-3	0	3	dB
Ch. 908 / 1884.46771 MHz	-6	-1	3	dB
GSM1900				
Ch. 496 / 1927.06771 MHz	-6	-1	2	dB
Ch. 512 / 1930.26771 MHz	-3	0	2	dB
Ch. 537 / 1935.26771 MHz	-3	0	2	dB
Ch. 586 / 1945.06771 MHz	-3	0	2	dB
Ch. 661 / 1960.06771 MHz	-3	0	2	dB
Ch. 736 / 1975.06771 MHz	-3	0	2	dB
Ch. 794 / 1986.66771 MHz	-3	0	2	dB
Ch. 810 / 1989.86771 MHz	-3	0	2	dB
Ch. 835 / 1994.86771 MHz	-6	-1	2	dB

12. If the values are within the limits, click **Next** to continue to the next band.

Next actions

Repeat the steps 8 to 12 for GSM1800 and GSM1900.

GSM transmitter tunings

Tx IQ tuning (GSM)

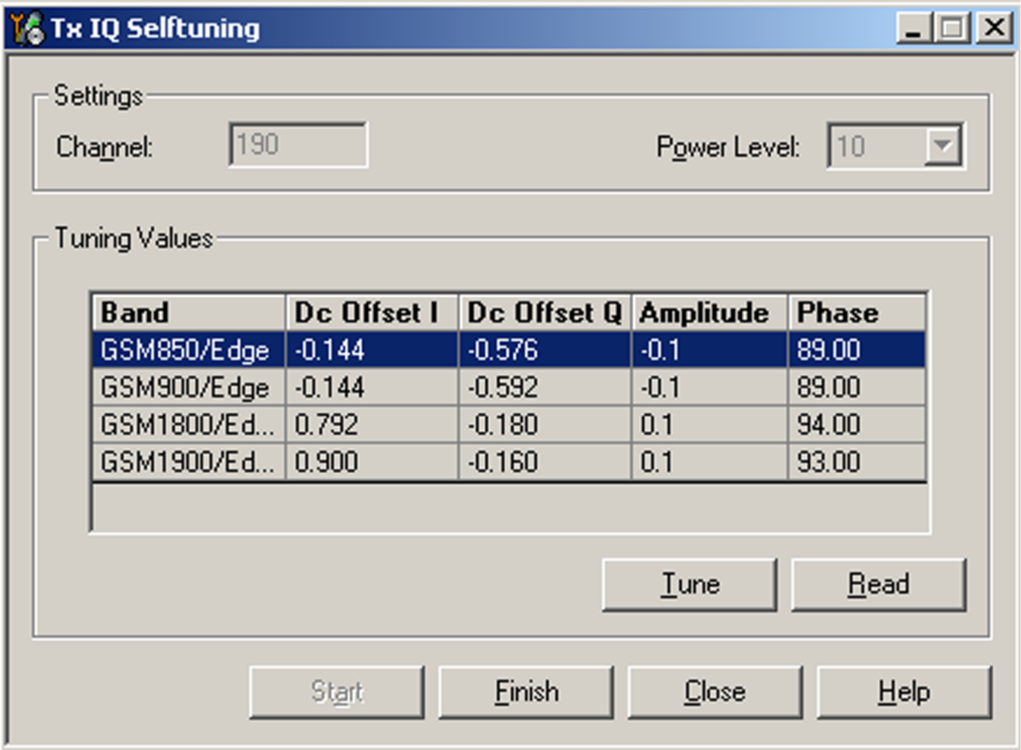
Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.

Tx IQ tuning must be performed for all GSM bands.

Steps

1. Start *Phoenix* service software.
2. From the **Operating mode** drop-down menu, set mode to **Local**.
3. Choose **Tuning→GSM→Tx IQ Tuning** .
4. Select **Mode: Automatic**.



Channel: 190
Power Level: 10

Band	Dc Offset I	Dc Offset Q	Amplitude	Phase
GSM850/Edge	-0.144	-0.576	-0.1	89.00
GSM900/Edge	-0.144	-0.592	-0.1	89.00
GSM1800/Ed...	0.792	-0.180	0.1	94.00
GSM1900/Ed...	0.900	-0.160	0.1	93.00

5. Select band **GSM850** or **GSM900** and click **Start**.
6. Click **Next** to start GSM1800 band TX IQ tuning.
7. Click **Next** to start GSM1900 band TX IQ tuning.
8. Click**Finish** and then **Close**.

Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
GSM850				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM900				

	Min	Typ	Max	Unit
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
GSM1800/GSM1900				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	°

Tx power level tuning (GSM)

Context

Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients’. These adjust the GSM transmitter output power to fulfill the specifications.

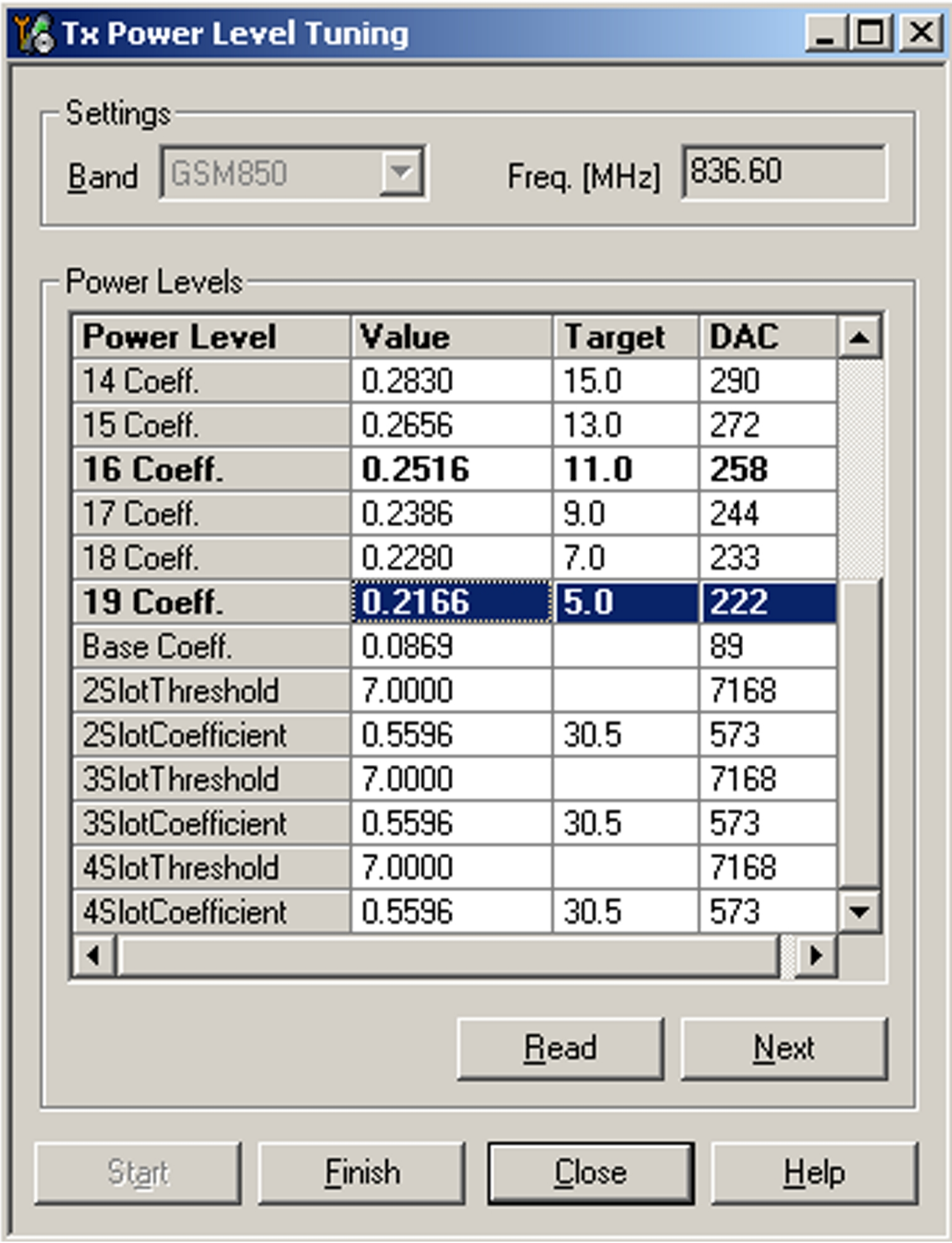
For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

Steps

1. Connect the phone to a spectrum analyzer.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Tx Power Level Tuning** .

5. Click **Start.**l



Tx Power Level Tuning
Settings
Band
GSM850
Freq. [MHz]
836.60
Power Levels
Read
Next
Start
Finish
Close
Help

Power Level	Value	Target	DAC
14 Coeff.	0.2830	15.0	290
15 Coeff.	0.2656	13.0	272
16 Coeff.	**0.2516**	**11.0**	**258**
17 Coeff.	0.2386	9.0	244
18 Coeff.	0.2280	7.0	233
19 Coeff.	**0.2166**	**5.0**	**222**
Base Coeff.	0.0869		89
2SlotThreshold	7.0000		7168
2SlotCoefficient	0.5596	30.5	573
3SlotThreshold	7.0000		7168
3SlotCoefficient	0.5596	30.5	573
4SlotThreshold	7.0000		7168
4SlotCoefficient	0.5596	30.5	573

6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: • **836.6 MHz GSM850** • **897.4MHz GSM900** • **1747.8MHz GSM1800** • **1880MHz GSM1900**
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)

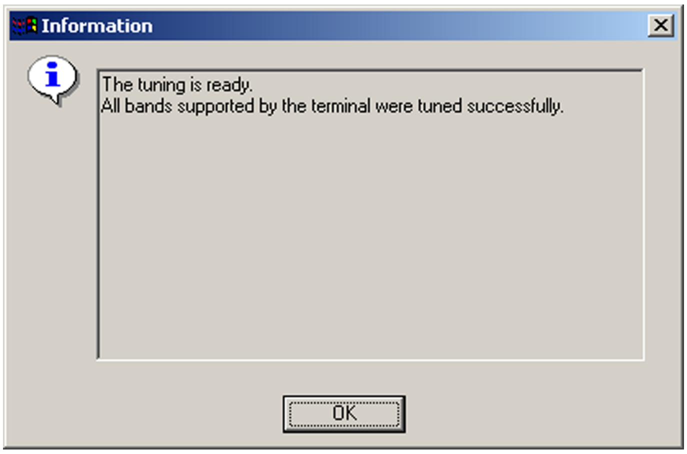
Resolution BW	3MHz
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations into account.

7. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.
8. If all bold power levels are adjusted, click **Next** to continue with **GSM850 EDGE**.
9. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing **+** or **–** keys.

Next actions

Continue tuning the bold power levels of the GSM900, GSM1800 and GSM1900 bands. You will see this message, if finished successfully:



The tuning is ready.
All bands supported by the terminal were tuned successfully.

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5 — System module

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Phone description

Introduction

This chapter describes the system module including engine, power management, interfaces, audio etc.

The baseband is based on BB5.0 with a RAPGSM main processor and Avilma/Betty energy management. All blocks that require high voltage process are in Betty and all other in Avilma. The RF part is based on the ASIC Ahne.

RM-249/250 is a monoblock phone, in which all electrical components are assembled into one PWB.

RM-249 operates on the GSM 900/1800/1900 bands.

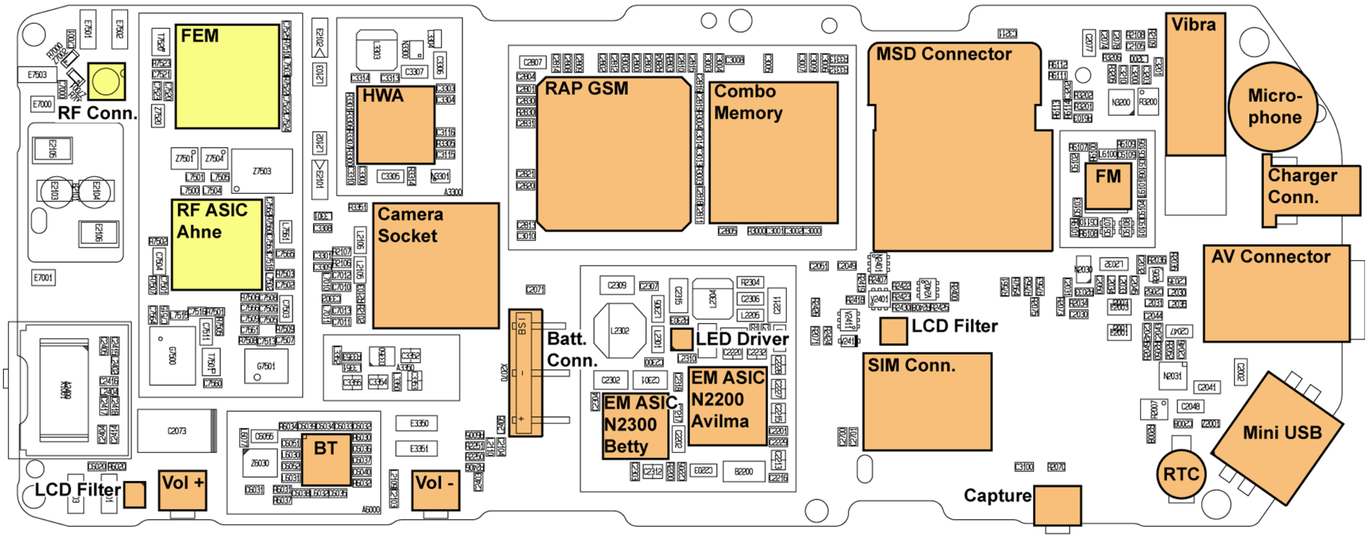
RM-250 operates on the GSM 850/1800/1900 bands.

Key components

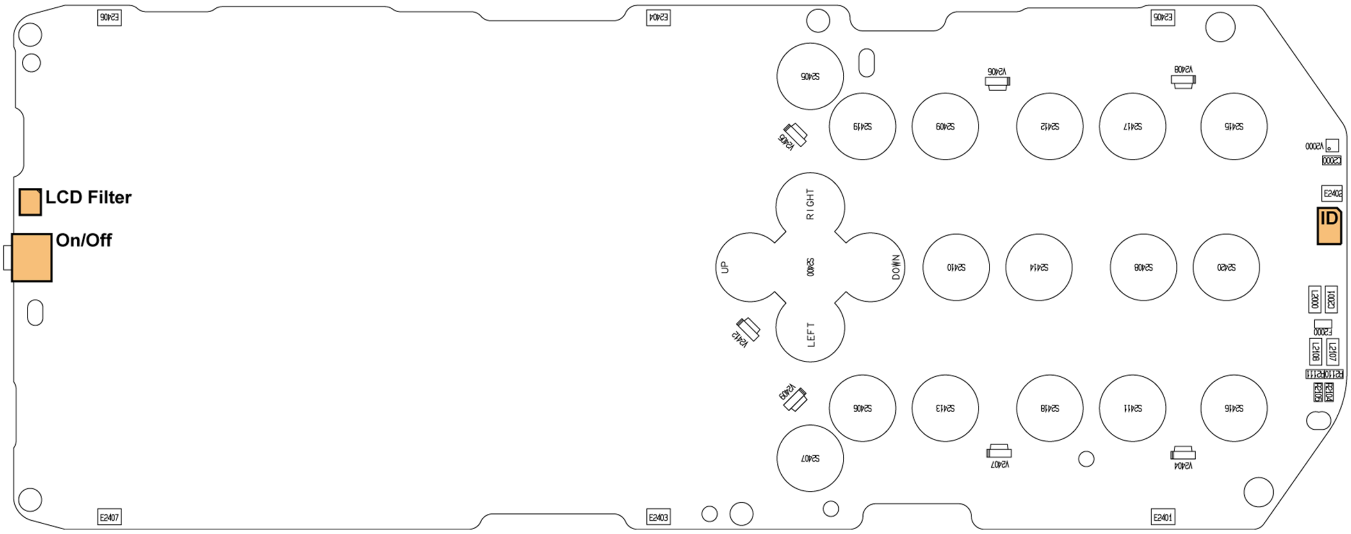
Function	Name	Item
Energy management	EM ASIC Avilma EM ASIC Betty	N2200 N2300
Main processor	RAPGSM	D2800
Memory	Combo: 128 Mbit SDRAM & 512 Mbit NOR flash	D3000
RF ASIC	Ahne	N7505
Front end module	Power amplifier and Antenna Switch	N7520
Antenna	Antenna module assembly • RM-249: 900/1800/1900 MHz • RM-250: 850/1800/1900 MHz	
System connector	AV connector mini USB connector	X2030 X2002
Battery	BL-4B, 3.7 V, 700 mAh	
Bluetooth	BC4-ROM	N6030
FM radio	TEA5760	N6102
IHF Speaker	Donau or Aura (in antenna module assembly)	
Earpiece	RDF-07A 32OHM 10.86x7.40.2.2	B2101
Microphone	Clapton	B2100
Vibra	SMD VIBRA MOTOR	M2100
Charger connector	2 mm Nokia charger interface	X2000
Camera	2.0 Mpix SMIA85	
HWA	STV0984N	D3300
Display	QVGA 240 x 320, 2"	
LED driver	TPS 61061 YZFR	N2301
RTC battery	311 size	G2200

PWB overview

2cma Top Side


FEM
RF Conn.
HWA
RAP GSM
Combo Memory
MSD Connector
Vibra
Micro-phone
Charger Conn.
FM
RF ASIC Ahne
Camera Socket
AV Connector
LCD Filter
Batt. Conn.
LED Driver
EM ASIC N2200 Avilma
EM ASIC N2300 Betty
SIM Conn.
Mini USB
RTC
LCD Filter
Vol +
BT
Vol -
Capture

2cma Bottom Side


LCD Filter
On/Off
ID
RIGHT
UP
DOWN
LEFT
S2400

System block diagram

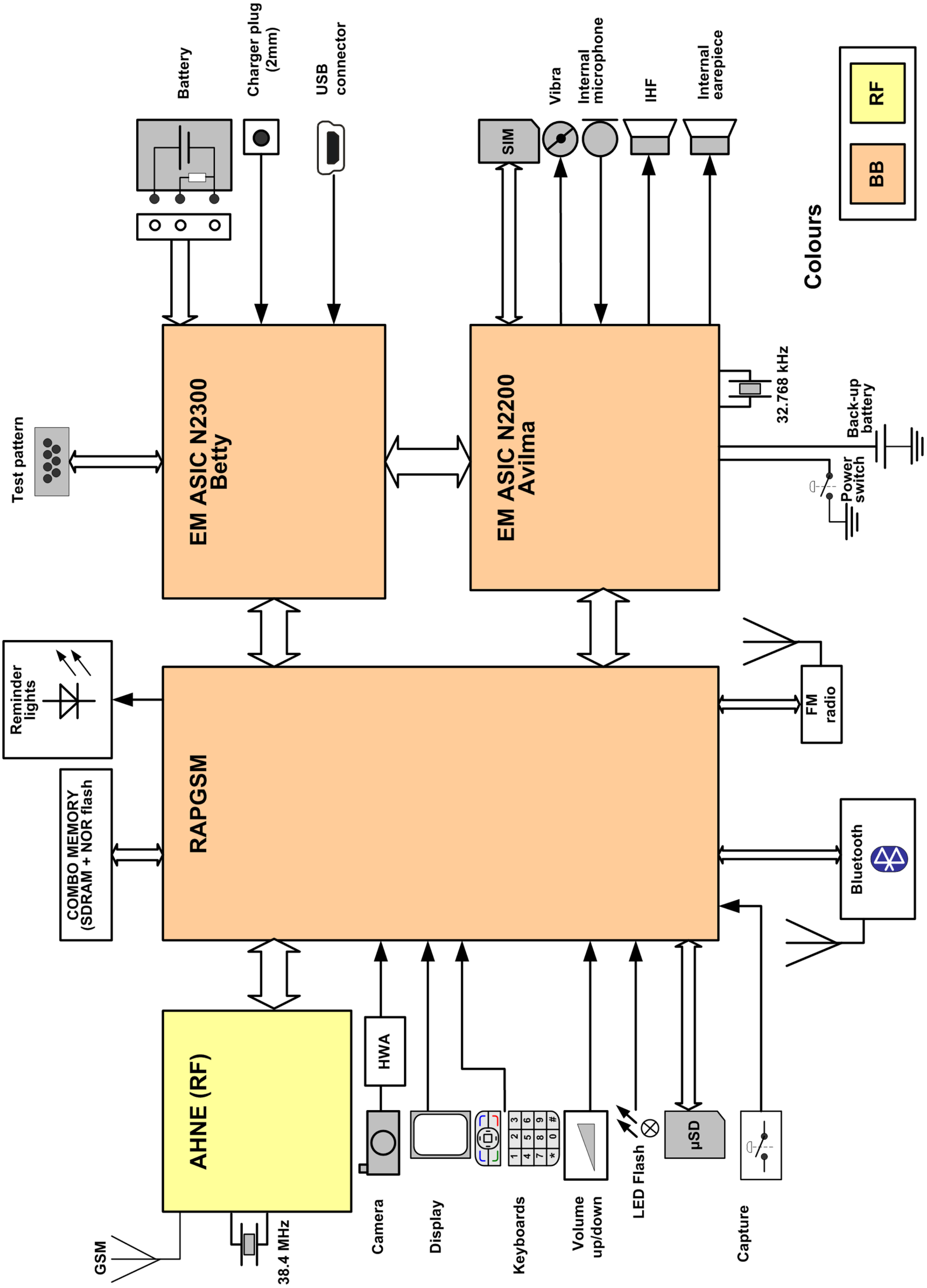

Battery
Charger plug (2mm)
USB connector
SIM
Vibra
Internal microphone
IHF
Internal earepiece
RF
BB
Colours
Test pattern
EM ASIC N2300 Betty
EM ASIC N2200 Avilma
32.768 kHz
Back-up battery
Power switch
Reminder lights
COMBO MEMORY (SDRAM + NOR flash)
RAPGSM
FM radio
Bluetooth
AHNE (RF)
HWA
µSD
GSM
38.4 MHz
Camera
Display
Keyboards
Volume up/down
LED Flash
Capture

Figure 23 System block diagram

Board and module connections

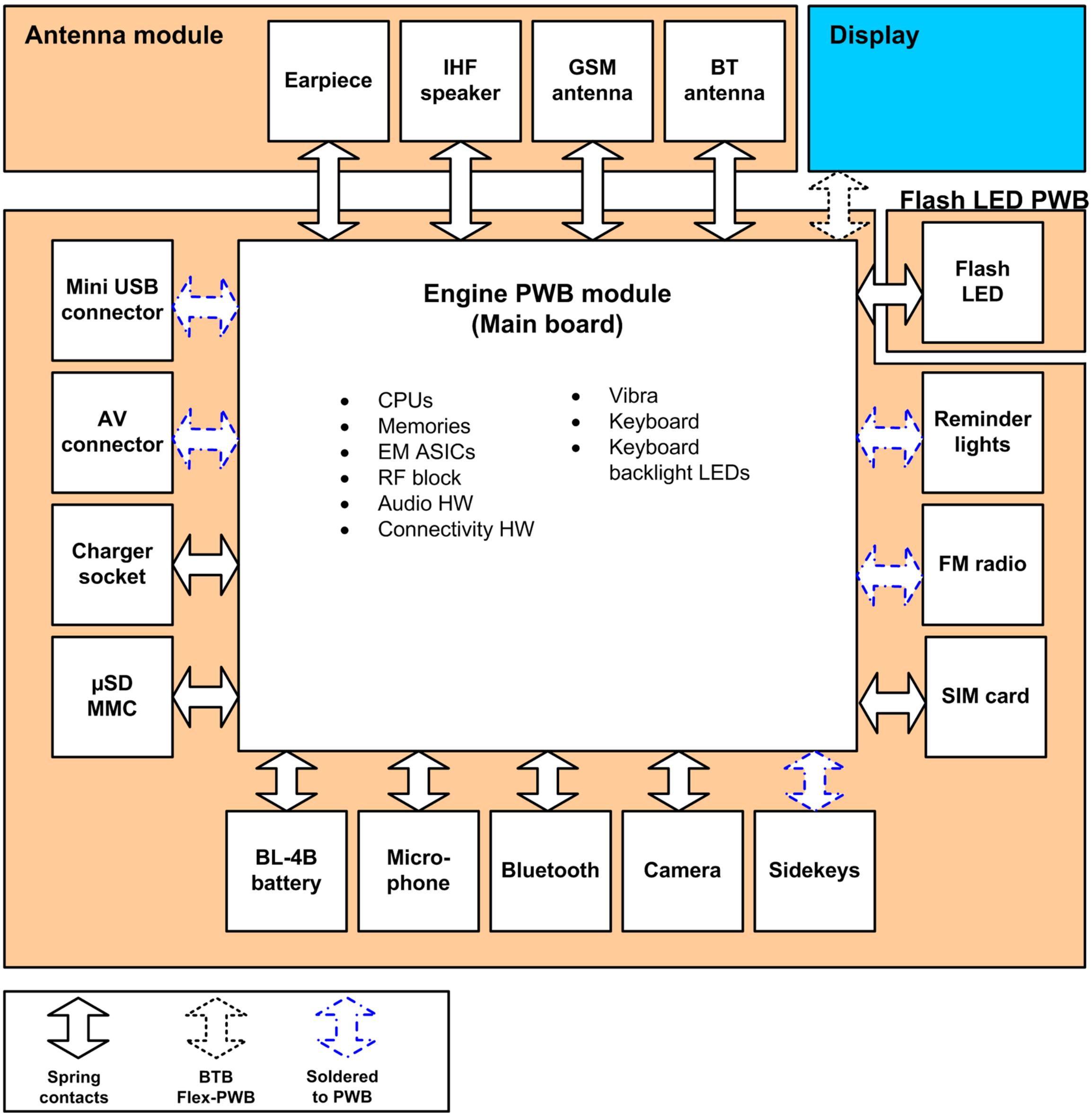

Antenna module
Earpiece
IHF speaker
GSM antenna
BT antenna
Display
Flash LED PWB
Flash LED
Mini USB connector
AV connector
Charger socket
µSD MMC
Engine PWB module
(Main board)
CPUs
Memories
EM ASICs
RF block
Audio HW
Connectivity HW
Vibra
Keyboard
Keyboard backlight LEDs
Reminder lights
FM radio
SIM card
BL-4B battery
Micro-phone
Bluetooth
Camera
Sidekeys
Spring contacts
BTB Flex-PWB
Soldered to PWB

Figure 24 Board and module connections

Energy management

Battery and charging

Battery

This device uses the BL-4B battery, a 700 mAh minimum Li-ion battery. It has a three contacts interface and it is based on a blade type connector.

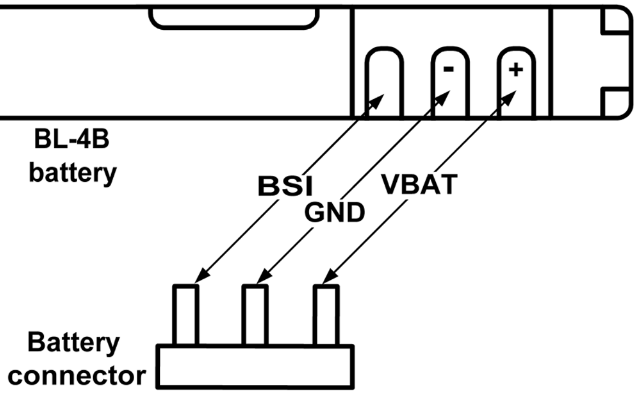


Figure 25 BL-4B battery and battery connector

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

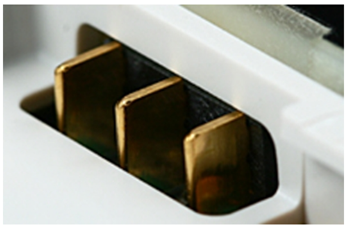


Figure 26 Blade battery connector

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The old standard charger (3.5 mm) can be used together with the CA-44 charger adapter.

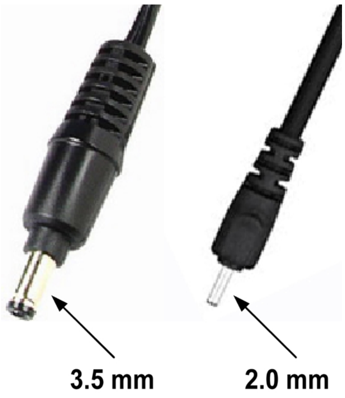


Figure 27 Old (left) and new (right) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) N2300 BETTY and N2200 AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BL-4B battery is used.

Table 6 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage	4.230	
(fast charging)		
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

When the battery is placed in the phone the power key circuits are energized. When the power key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.

Mode	Description
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Clocking scheme

In BB5.0, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by EM ASIC N2200 with an external crystal.

32 k Sleep Clock is always powered on after startup. Sleep clock is used by RAP for low-power operation.

SMPS Clk is 2.4 MHz clock line from RAP to EM ASIC N2300. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4 MHz signal from RF ASIC to BT module.

CLK600. The clock source is an internal RC oscillator in EM ASIC N2300 (during the power-up sequence) or RAPIDO SMPS Clk.

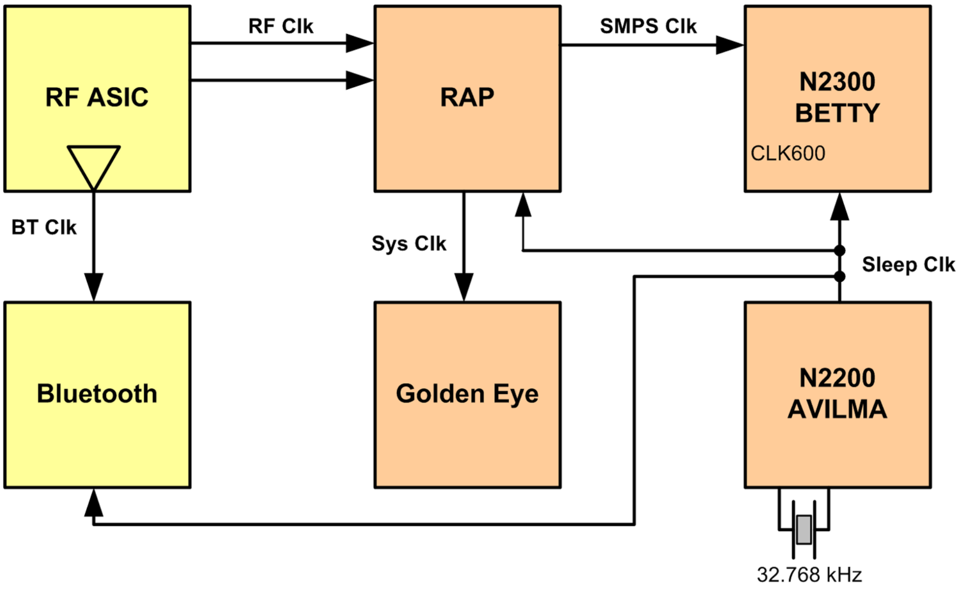


Figure 28 Clocking scheme

USB, SIM, µSD

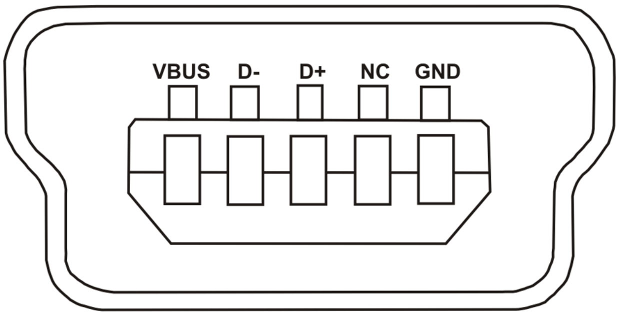
USB

USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for mini USB.


VBUS
D-
D+
NC
GND

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAP and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

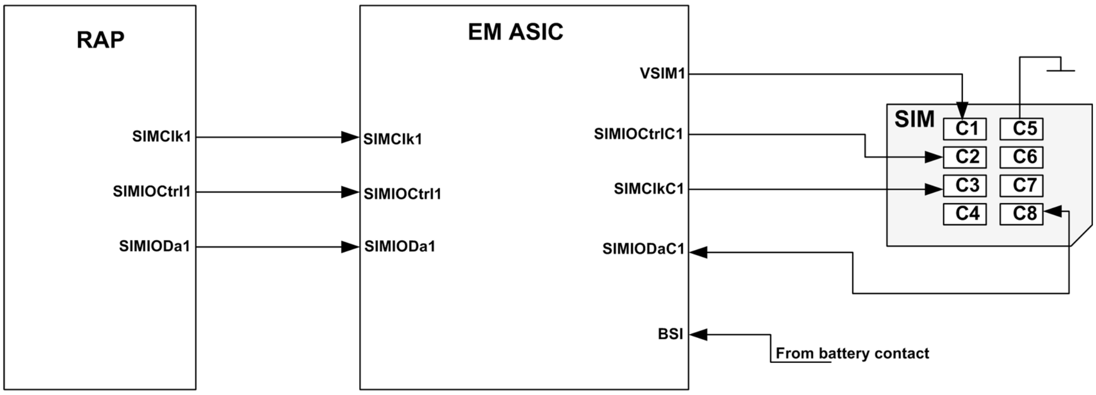
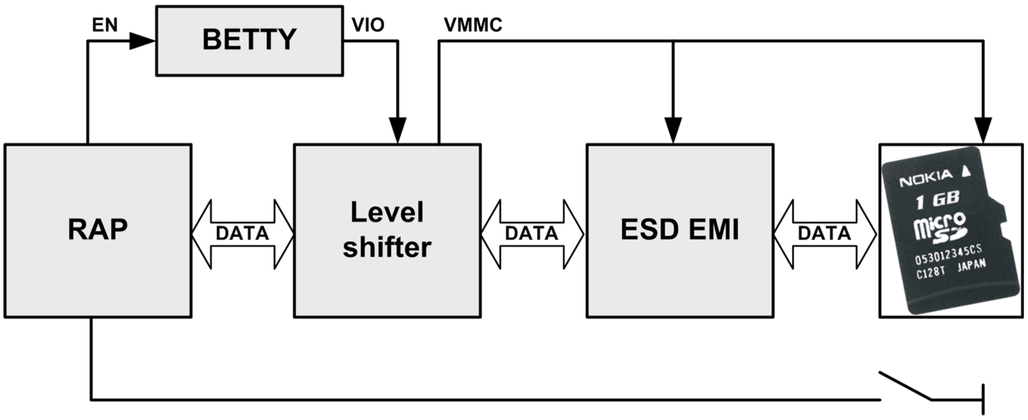

RAP
SIMClk1
SIMIOCtrl1
SIMIODa1
EM ASIC
SIMClk1
SIMIOCtrl1
SIMIODa1
VSIM1
SIMIOCtrlC1
SIMClkC1
SIMIODaC1
BSI
SIM
C1
C2
C3
C4
C5
C6
C7
C8
From battery contact

Figure 29 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM interface.

The SIM interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

µSD card interface


EN
BETTY
VIO
VMMC
RAP
DATA
Level shifter
DATA
ESD EMI
DATA
NOKIA
1 GB
micro SD
053012345CS
C128T JAPAN

The µSD card is connected to the engine by an external level shifter and ESD protection filter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

The card removal is detected by a push detect switch.

AV connector

Headsets and other galvanic accessories are connected to the specific audio input. The accessory mode is automatically enabled/disabled when a dedicated accessory is connected/disconnected.

> **Note:** When testing external audio through the audio connector, make sure that the specific accessory can be used with this phone!

Camera concept

This phone has a 2.0 megapixel camera module. It has a dedicated capture key and LED flash. All are controlled by RAP via a hardware accelerator (Golden eye), which has some dedicated SDRAM.

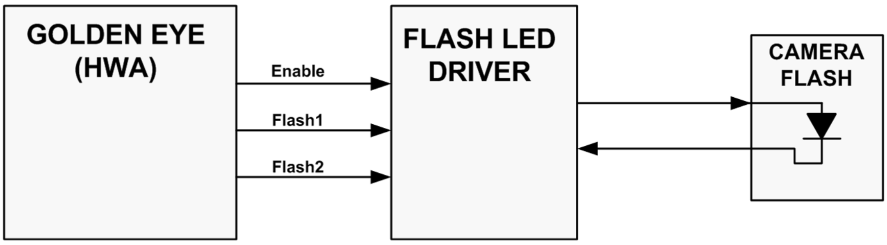


Figure 30 Camera flash LED block diagram

User interface

Display

The display unit comprises a parallel interface.

Keyboard

All keys are placed on the main PWB.

- Numeric keys
- Navigation key, Soft keys, Start, and End
- Power switch
- Volume up and down switch
- Camera capture key

Display and keypad backlight

There are two sets of LEDs illuminating the display and the keypads:

- Display LEDs, 2 pcs
- Main keypad on PWB, 6 pcs, white colour
- Reminder lights on PWB, 1 pcs, white colour

All sets share the same driver. None of the keypads can be illuminated without the LCD backlight being turned on.

Audio concept

The functional core of the audio hardware is built around two ASICs; Energy management ASICs N2200 and N2300.

N2200 provides an interface for the trancducers and the AV connector.

There are three audio transducers:

- 1 earpiece
- 1 IHF speaker
- 1 microphone module

N2200 also provides an output for the vibra motor.

All external audio accessories are connected to the specific audio connector.

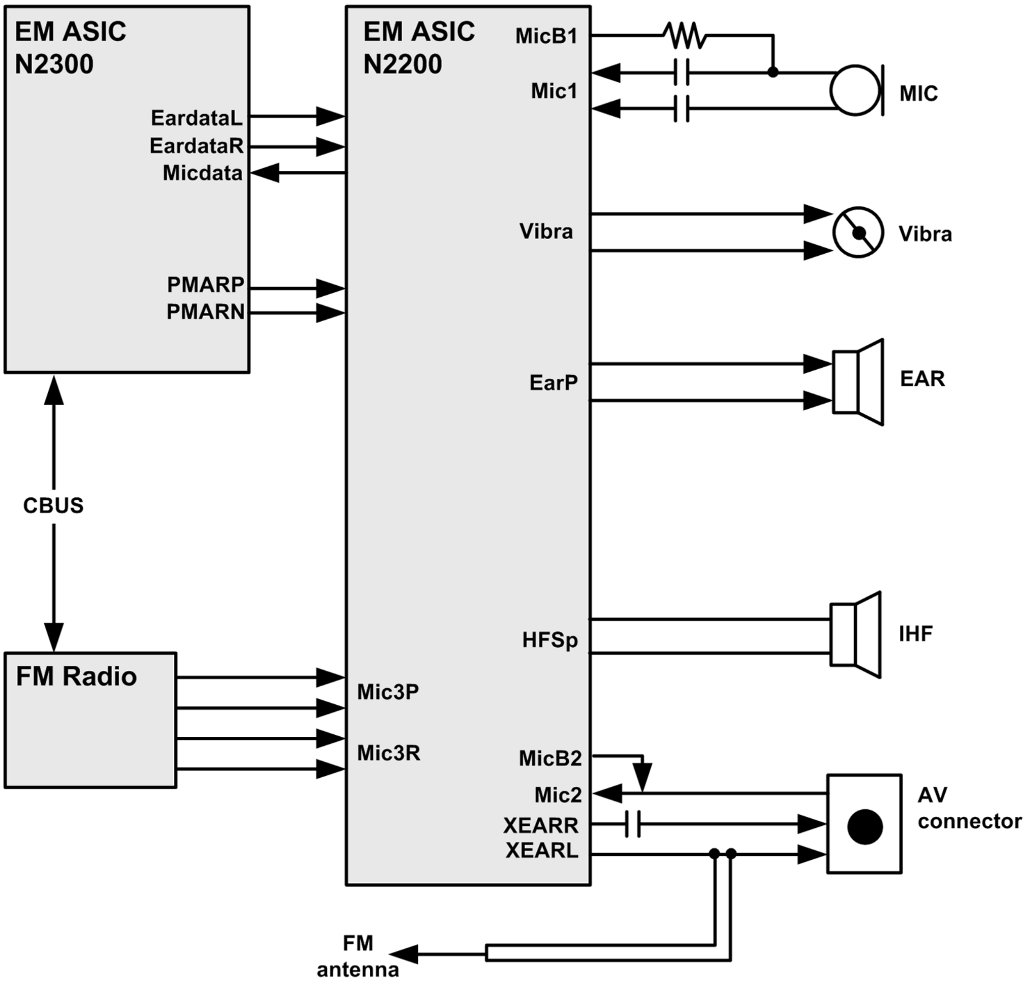

EM ASIC
N2300
EardataL
EardataR
Micdata
PMARP
PMARN
CBUS
FM Radio
EM ASIC
N2200
MicB1
Mic1
MIC
Vibra
Vibra
EarP
EAR
HFSp
IHF
Mic3P
Mic3R
MicB2
Mic2
XEARR
XEARL
AV
connector
FM
antenna

Figure 31 Audio block diagram

Internal audio

The internal audio components are used in these modes:

	Hand portable (HP) mode	Internal hands free (IHF) mode
Microphone	X	X
Earpiece	X	
Speaker		X

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Data and control interface for a low power RF module is provided by the module.

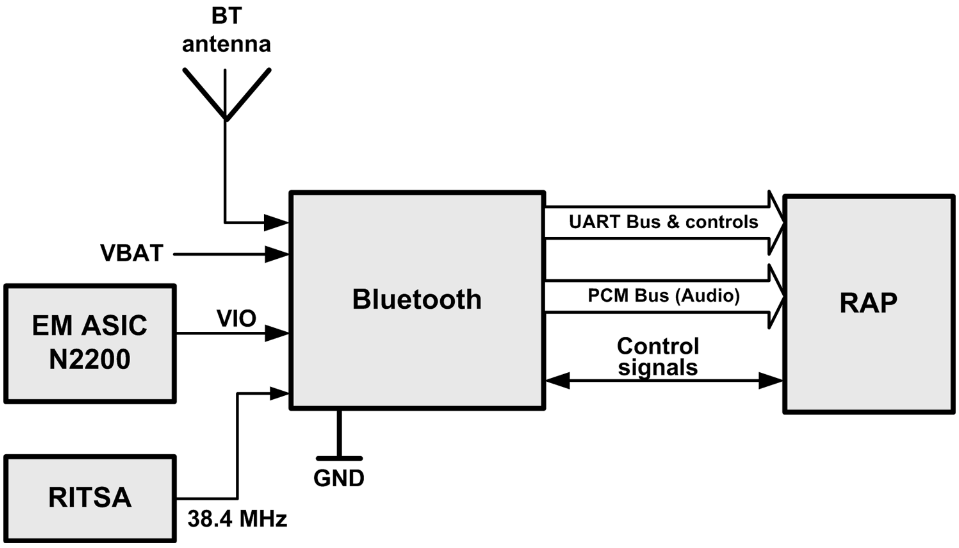

BT
antenna
VBAT
EM ASIC
N2200
VIO
RITSA
38.4 MHz
Bluetooth
GND
UART Bus & controls
PCM Bus (Audio)
Control
signals
RAP

Figure 32 Bluetooth interface

The Bluetooth has a separate built in antenna and is powered by VBAT and the regulated voltage VIO. For audio applications the Bluetooth has a PCM data bus. In addition a UART (universal asynchronous receiver/transmitter) is used for data communication and controls.

FM radio

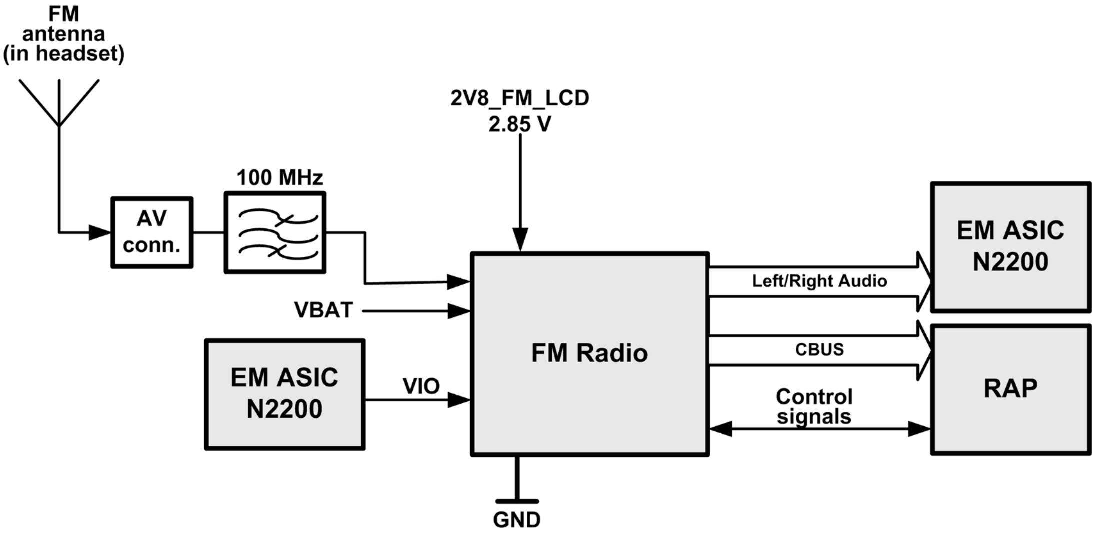

FM
antenna
(in headset)
AV
conn.
100 MHz
2V8_FM_LCD
2.85 V
VBAT
EM ASIC
N2200
VIO
FM Radio
GND
Left/Right Audio
CBUS
Control
signals
EM ASIC
N2200
RAP

Figure 33 FM interface

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as poles of the antenna, and no other antenna is needed for FM radio reception.

The FM radio is provided with LDO (low drop out) voltage 2V8_FM_LCD.

The radio has an automatic band search function, which can search for a strong write/read signal from a certain frequency. When this is found, data is transmitted to the radio. When the signal strength is low, the EM ASIC N2200 (AVILMA) can read data, which is available until the signal is strong again.

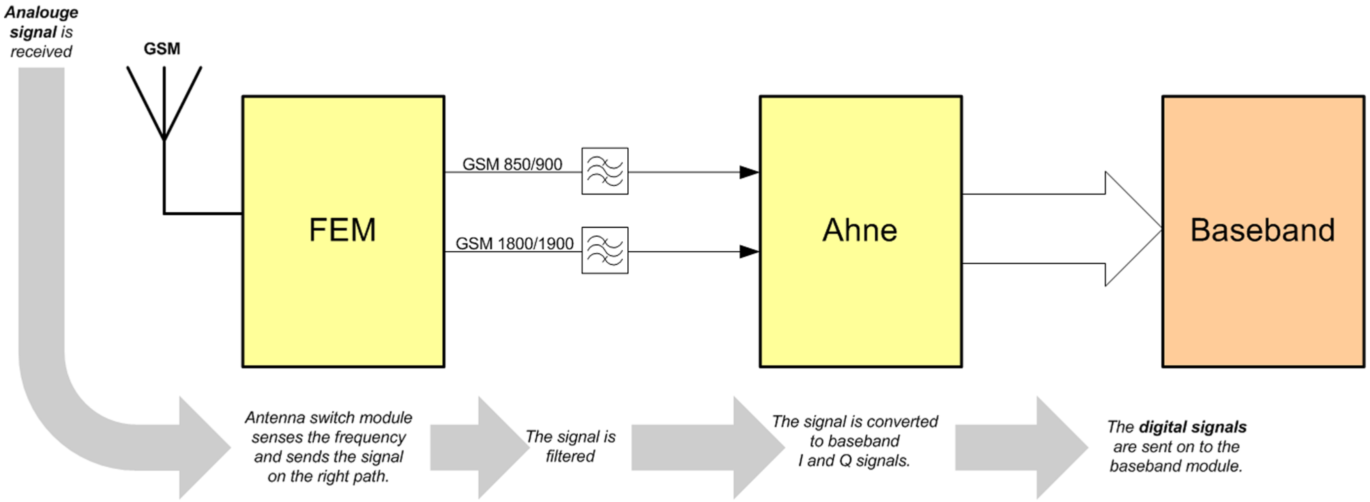
RF description

Receiver (RX)

An analouge signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

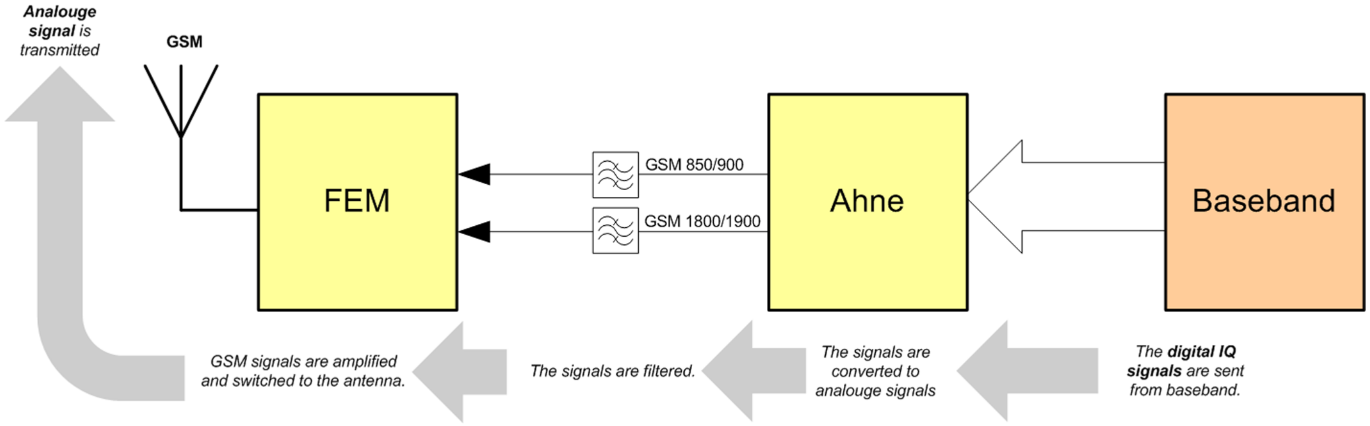
Signals with different frequencies take different paths, therefore being handled by different components.


Analouge signal is received
GSM
FEM
GSM 850/900
GSM 1800/1900
Ahne
Baseband
Antenna switch module senses the frequency and sends the signal on the right path.
The signal is filtered
The signal is converted to baseband I and Q signals.
The **digital signals** are sent on to the baseband module.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analouge signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwith of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.


Analouge signal is transmitted
GSM
FEM
GSM 850/900
GSM 1800/1900
Ahne
Baseband
GSM signals are amplified and switched to the antenna.
The signals are filtered.
The signals are converted to analouge signals
The **digital IQ signals** are sent from baseband.

Technical specifications

Environmental conditions

Temperature

Temperature range	Min ºC	Max ºC
Operational (all specs met)	-5	+55
Functional (reduced performance)	-30	+70
Storage	-30	+85

The HW module complies with the SPR4 Operating Conditions.

Humidity

Relative humidity range is 5...95%.

The hardware module is not protected against water. Condensed or splashed water might cause malfunction. Any submerge of the phone will cause permanent damage. Long-term high humidity, with condensation, will cause permanent damage because of corrosion.

The hardware module complies with the SPR4 Operating Conditions.

Main RF characteristics

Table 7 Channel numbers and frequencies

System	Channel number	TX frequency	RX frequency	Unit
GSM850	128 <= n <= 251	F = 824.2 + 0.2*(n - 128)	F = 869.2 + 0.2*(n-128)	MHz
GSM900	0 < =n <= 124	F = 890 + 0.2*n	F = 935 + 0.2*n	MHz
	975 <= n <= 1023	F = 890 + 0.2* (n - 1024)	F = 935 + 0.2*(n -1024)	MHz
GSM1800	512 <= n <= 885	F = 1710.2 + 0.2* (n - 512)	F = 1805.2 + 0.2*(n-512)	MHz
GSM1900	512 <= n <= 810	F = 1850.2 + 0.2* (n - 512)	F = 1930.2 + 0.2*(n-512)	MHz

Table 8 Main RF characteristics

Parameter	Unit and value
Cellular systems	**RM-249**: EGSM900/GSM1800/GSM1900 **RM-250**: GSM850/GSM1800/GSM1900

Parameter	Unit and value
RX Frequency range	GSM850: 869 ... 894 MHz
	EGSM900: 925 ... 960 MHz
	GSM1800: 1805...1880 MHz
	GSM1900: 1930...1990 MHz
TX Frequency range	GSM850: 824 ... 849 MHz
	EGSM900: 880 ... 915 MHz
	GSM1800: 1710 ...1785 MHz
	GSM1900: 1850...1910 MHz
Duplex spacing	GSM850: 45 MHz
	EGSM900: 45 MHz
	GSM1800: 95 MHz
	GSM1900: 80 MHz
Channel spacing	200 kHz
Number of RF channels	GSM850: 124
	EGSM900: 174
	GSM1800: 374
	GSM1900: 300
Output Power	GSM850: GSMK 5...33 dBm
	GSM850: 8-PSK 5...26.5 dBm
	EGSM900: GSMK 5...33 dBm
	EGSM900: 8-PSK 5...26.5 dBm
	GSM1800: GSMK 0...30 dBm
	GSM1800: 8-PSK 0...25.5 dBm
	GSM1900: GSMK 0...30 dBm
	GSM1900: 8-PSK 0...25.5 dBm
Number of power levels GMSK	GSM850: 15
	EGSM900: 15
	GSM1800: 16
	GSM1900: 16
Number of power levels 8-PSK	GSM850: 12
	EGSM900: 12
	GSM1800: 14
	GSM1900: 14

Table 9 Transmitter characteristics

Item	Values
Type	Direct conversion, nonlinear, FDMA/TDMA
LO frequency range	GSM850: 3296...3576 MHz (4 x TX freq)
	EGSM900: 3520...3660 MHz (4 x TX freq)
	GSM1800: 3420...3570 MHz (2 x TX freq)
	GSM1900: 3700...3820 MHz (2 x TX freq)
Output power (GSM850/EGSM900/GSM1800/ GSM1900)	GMSK 33/33/30/30 dBm 8-PSK 26.5/26.5/25.5/25.5 dBm
Gain control range	min. 30 dB
Phase error (RMS/peak), GMSK	5 deg./20 deg. peak
EVM (RMS/peak), 8-PSK	10%/30%

Table 10 Receiver characteristics

Item	Values
Type	Direct conversion, Linear, FDMA/TDMA
LO frequencies	GSM850: 3476..3576 MHz (4 x RX freq)
	EGSM900: 3700...3840 MHz (4 x RX freq)
	GSM1800: 3610...3760 MHz (2 x RX freq)
	GSM1900: 3860...3980 MHz (2 x RX freq)
Typical 3 dB bandwidth	+/- 91 kHz
Sensitivity	min. - 102 dBm (normal condition)
Total typical receiver voltage gain (from antenna to RX ADC)	86 dB
Receiver output level (RF level -95 dBm)	40 mVpp, single-ended I/Q signals to RX ADCs

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Glossary

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A/D-converter	Analog-to-digital converter
ACI	Accessory Control Interface
ADC	Analog-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic ,type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2,UEME and Zocus
CCP	Compact Camera Port
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSR	cambridge silicon radio
CSTN	Color Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analouge converter
DAC	Digital-to-analouge converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package

DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evaluation
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compability
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Assosiasion
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out

LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architechture
OMAP	Operations, maintenance, and administartion part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort TM	Reduced function PopPortTM interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multi Media Card
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)

RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noice ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WD	Watchdog
XHTML	Extensible hypertext markup language
Zocus	Current sensor, (used to monitor the current flow to and from the battery)